

**DOCUMENT RESUME****ED 096 441****95****CE 002 042**

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**TITLE** Career Preparation in Ornamental Horticulture: A Curriculum Guide for High School Vocational Agriculture. Test Edition.

**INSTITUTION** Ohio State Univ., Columbus. Ohio Career Education and Curriculum Management Lab. in Agricultural Education.

**SPONS AGENCY** Bureau of Occupational and Adult Education (DHEW/OE), Washington, D.C.

**PUB DATE** 74

**NOTE** 244p.; For related documents, see CE 002 036-045

**AVAILABLE FROM** Agricultural Education Curriculum Materials Service, Room 254, 2120 Pyffe Road, The Ohio State University, Columbus, Ohio 43210 (\$4.00)

**EDRS PRICE** MF-\$0.75 HC-\$11.40 PLUS POSTAGE

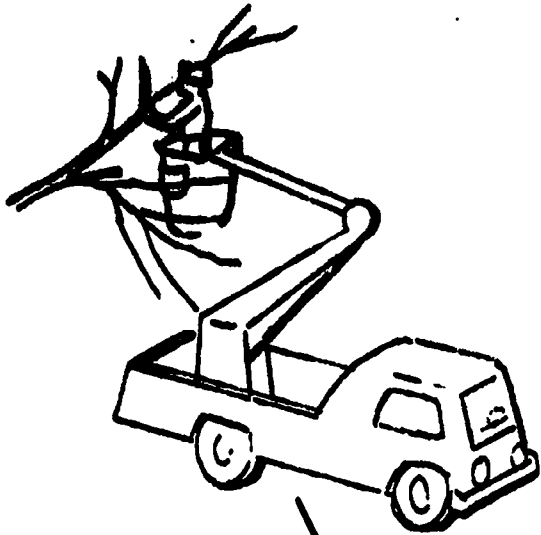
**DESCRIPTORS** Agricultural Skills; Behavioral Objectives; \*Career Education; \*Curriculum Guides; \*Curriculum Planning; Floriculture; Grounds Keepers; Landscaping; Learning Activities; Nurseries (Horticulture); Occupational Clusters; \*Ornamental Horticulture; Ornamental Horticulture Occupation; Plant Science; Secondary Grades; Teaching Guides; \*Vocational Agriculture

**IDENTIFIERS** Arboriculture

**ABSTRACT**

This curriculum guide in ornamental horticulture is one of 10 guides developed as part of a vocational project stressing agribusiness, natural resources, and environmental protection. The scope of this guide includes five occupational subgroups: arboriculture, floriculture, landscape maintenance and establishment, nursery production, and turfgrass maintenance and equipment. It is meant as an aid to all who are involved in the curriculum planning phases prior to classroom instruction. Each unit has seven elements to be used for developing specific curriculum and curriculum materials: unit concept, student performance objectives, instructional areas, examples of learning activities, examples of evaluation processes, instructional materials or equipment, and references. Appendixes list recommended materials and equipment, additional references, and selected professional and technical societies. (Author/JC)

ED 096441



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Career Preparation in

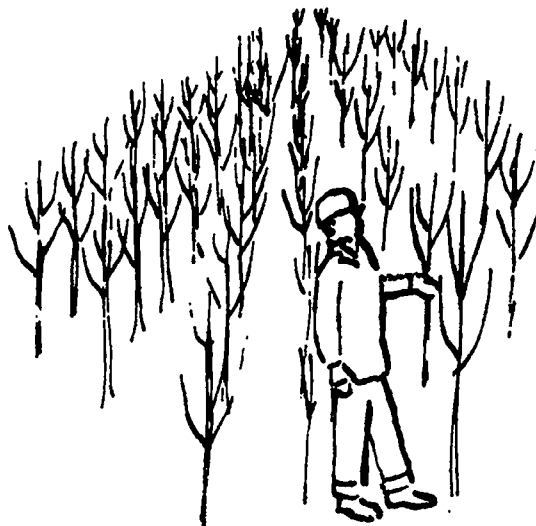
# ORNAMENTAL HORTICULTURE

A Curriculum Guide

For High School Vocational Agriculture

U.S. DEPARTMENT OF HEALTH,  
EDUCATION & WELFARE  
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EDUCATION

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**CAREER EXPLORATION IN AGRIBUSINESS, NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION: A CURRICULUM GUIDE FOR GRADES 7-9.**

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BY

OHIO CAREER EDUCATION AND CURRICULUM  
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THE OHIO STATE UNIVERSITY  
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1974

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## FOREWORD

THIS SUGGESTED CURRICULUM GUIDE IN ORNAMENTAL HORTICULTURE IS ONE OF TEN GUIDES DEVELOPED UNDER THE DIRECTION OF THE OHIO CAREER EDUCATION AND CURRICULUM MANAGEMENT LABORATORY OF THE DEPARTMENT OF AGRICULTURAL EDUCATION COLLEGE OF AGRICULTURE, THE OHIO STATE UNIVERSITY AND THE OHIO DEPARTMENT OF EDUCATION, AS A PART OF THE PROJECT ENTITLED "CURRICULUM DEVELOPMENT BASIC TO THE TRAINING OF INDIVIDUALS FOR EMPLOYMENT IN AGRIBUSINESS, NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION." THE PROJECT WAS FUNDED UNDER A CONTRACT WITH THE BUREAU OF OCCUPATIONAL AND ADULT EDUCATION, U.S. OFFICE OF EDUCATION.

THE PROJECT GREW OUT OF THE NEED TO IDENTIFY THE EDUCATIONAL EXPERIENCES MOST APPROPRIATE FOR CAREER DEVELOPMENT IN AGRIBUSINESS, NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION. EDUCATORS WERE LACKING ADEQUATE AND ACCURATE INFORMATION FOR THE CAREER AWARENESS AND EXPLORATION STAGES OF THE CAREER DEVELOPMENT PROCESS CONCERNING THE AGRIBUSINESS COMPLEX.

THE AGRIBUSINESS COMPLEX ALSO HAD SEVERAL EMERGING PROGRAM AREAS WHERE OCCUPATIONAL COMPETENCIES AND THE RELATED CURRICULUM HAD NOT BEEN WELL DEFINED AT THE VOCATIONAL PREPARATION LEVEL. THESE CONDITIONS CAUSED APPROPRIATE CAREER DEVELOPMENT PROGRAMS TO BE LACKING OR INEFFECTIVE AT ALL LEVELS, LEADING UP TO AND INCLUDING VOCATIONAL EDUCATION, BECAUSE GUIDANCE IN MATERIALS AND PROCESSES OF CONDUCTING THESE PROGRAMS WERE NOT ADEQUATELY DEVELOPED.

IN MAY OF 1971, AGRICULTURAL LEADERS REPRESENTING STATE SUPERVISORS, TEACHER EDUCATORS, CLASSROOM TEACHERS AND THE AGRICULTURAL BUSINESS AND INDUSTRIAL COMMUNITY MET IN DENVER, COLORADO, TO DISCUSS THE CHANGING NATURE OF THE FIELD. THERE WAS GENERAL AGREEMENT THAT THE DEVELOPING EMPHASIS ON AGRIBUSINESS, NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CALLED FOR MAJOR CURRICULUM CHANGES AND DEVELOPMENT OF NEW CURRICULA, WITH CHANGES IN THE PREPARATION OF AGRICULTURAL EDUCATION PERSONNEL AT THE SAME TIME.

THE PURPOSES OF THIS PROJECT WERE: (1) TO DEVELOP APPROPRIATE CURRICULUM GUIDES IN AGRIBUSINESS, NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION WHICH PROVIDE A COORDINATED EDUCATIONAL PROGRAM, INCLUDING CAREER AWARENESS, CAREER EXPLORATION AND PREPARATION FOR A CLUSTER OF OCCUPATIONS; (2) TO ACQUAINT EDUCATIONAL LEADERSHIP IN ALL STATES WITH THE CURRICULUM MATERIALS FROM THIS PROJECT AND PROMOTE THEIR USE; AND (3) TO DISSEMINATE COPIES OF THE CURRICULUM MATERIALS TO LEADERS OF EACH STATE.

## ACKNOWLEDGEMENTS

THIS CURRICULUM GUIDE WAS DEVELOPED BY MAX MC GHEE, CURRICULUM SPECIALIST ASSOCIATE, DEPARTMENT OF AGRICULTURAL EDUCATION, THE OHIO STATE UNIVERSITY, WITH ASSISTANCE FROM THE STAFF OF THE OHIO CAREER EDUCATION AND CURRICULUM MANAGEMENT LABORATORY IN AGRICULTURAL EDUCATION AND THE PROJECT ADVISORY COMMITTEES FOR ASSISTANCE IN PLANNING AND REVIEWING THE GUIDES. APPRECIATION IS ALSO EXTENDED TO DR. ELIZABETH J. SIMPSON, BRANCH CHIEF, CURRICULUM DEVELOPMENT BRANCH, DIVISION OF RESEARCH AND DEMONSTRATION, OCCUPATIONAL AND ADULT EDUCATION AND TO THE LATE DR. PHILLIP TESKE, PROJECT OFFICER, U.S. OFFICE OF EDUCATION, BUREAU OF OCCUPATIONAL AND ADULT EDUCATION FOR THEIR DIRECTION DURING THE PREPARATION OF THIS GUIDE. ALSO, GRATITUDE IS EXTENDED TO THE TEACHERS AND INDUSTRY PERSONNEL WHO HAVE GIVEN TIME FROM THEIR JOBS TO ASSIST IN A CRITIQUE OF THE GUIDES.

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# TABLE OF CONTENTS

FOREWORD . . . . .	111
ACKNOWLEDGEMENTS . . . . .	1v
THE USE OF THE CURRICULUM GUIDE . . . . .	1
ORGANIZATION OF INSTRUCTIONAL UNITS . . . . .	2
FORMAT OF THE UNITS OF INSTRUCTION . . . . .	3
RECOMMENDED FACILITIES AND EQUIPMENT . . . . .	6
TEACHER REQUIREMENTS AND RESPONSIBILITIES . . . . .	10
SCIENTIFIC AND TECHNICAL SOCIETIES AND TRADE ASSOCIATIONS . . . . .	11
EMPLOYMENT OPPORTUNITIES IN ORNAMENTAL HORTICULTURE . . . . .	12
VALIDATION OF ORNAMENTAL HORTICULTURE UNITS . . . . .	18
I. UNITS GENERAL TO THE ORNAMENTAL HORTICULTURE AREAS . . . . .	21
OCCUPATIONAL OPPORTUNITIES IN ORNAMENTAL HORTICULTURE . . . . .	23
DEVELOPING LEADERSHIP THROUGH FFA . . . . .	29
ORNAMENTAL HORTICULTURE SALESMANSHIP AND SELLING . . . . .	35
EMPLOYABILITY SKILLS AND HUMAN RELATIONS . . . . .	41
HAND AND POWER TOOLS AND HARDWARE USED IN ORNAMENTAL HORTICULTURE . . . . .	45
OPERATION AND CARE OF SMALL GASOLINE ENGINES . . . . .	51
MAINTENANCE OF SMALL GASOLINE ENGINES . . . . .	55
OPERATION AND MAINTENANCE OF GASOLINE AND DIESEL POWER UNITS . . . . .	59
II. ARBORICULTURE . . . . .	67
IDENTIFICATION AND SELECTION OF TREES AND SHRUBS . . . . .	69
PLANTING TREES AND SHRUBS . . . . .	73
APPLICATION OF FERTILIZER TO TREES . . . . .	77
PRUNING, TREES, SHRUBS AND HEDGES . . . . .	81
TREE MAINTENANCE PROCEDURES . . . . .	85
III. FLORICULTURE . . . . .	91
PLANTING MEDIA PREPARATION . . . . .	93
GREENHOUSE PLANT PROPAGATION . . . . .	97
FERTILIZATION OF FLORAL PLANTS . . . . .	103
MAINTAINING DESIRABLE ENVIRONMENTAL CONDITIONS IN THE GREENHOUSE . . . . .	107



INSECT AND DISEASE CONTROL IN THE GREENHOUSE . . .	113
USE AND CHARACTERISTICS OF FLOWERS, PLANTS AND DEC- ORATIVE MATERIALS . . . . .	117
ARRANGING AND DESIGNING WITH FLOWERS AND DECORATIVE MATERIALS . . . . .	121
IV. LANDSCAPE MAINTENANCE AND ESTABLISHMENT . . . . .	125
LANDSCAPE SITE PREPARATION . . . . .	127
PLANTING LANDSCAPE PLANTS AND TREES . . . . .	131
WATERING AND WEED CONTROL OF LANDSCAPE PLANTS . .	135
FERTILIZING ESTABLISHED LANDSCAPE PLANTS AND TREES	141
LANDSCAPE INSECT AND DISEASE CONTROL . . . . .	145
PRUNING LANDSCAPE PLANTS AND TREES . . . . .	149
V. NURSERY PRODUCTION . . . . .	153
IDENTIFICATION AND SELECTION OF NURSERY STOCK . .	155
PLANTING MEDIA PROPAGATION . . . . .	159
PLANTING AND TRANSPLANTING NURSERY STOCK . . . . .	163
SEXUAL PROPAGATION . . . . .	169
PROPAGATION BY CUTTINGS . . . . .	173
GRAFTING AND BUDDING . . . . .	177
FERTILIZATION OF NURSERY STOCK . . . . .	181
PRUNING NURSERY STOCK . . . . .	185
NURSERY WEED CONTROL . . . . .	189
NURSERY DISEASE, INSECT AND PEST CONTROL . . . . .	193
SAFE USE OF PEST CONTROL CHEMICAL . . . . .	199
VI. TURFGRASS MAINTENANCE AND ESTABLISHMENT . . . . .	205
SELECTING TURFGRASSES FOR NEW PLANTINGS . . . . .	207
TURF SITE PREPARATION . . . . .	211
TURF ESTABLISHMENT BY SEEDING AND VEGETATIVELY PLANTING . . . . .	215
MOWING TURF AREAS . . . . .	219
MAINTAINING TURF FERTILITY . . . . .	223
WATERING TURF AREAS . . . . .	227
TURF WEED CONTROL . . . . .	231
TURF DISEASE, INSECT AND ANIMAL PEST CONTROL . . .	235
SAFE USE OF PEST CONTROL CHEMICALS . . . . .	239
RENOVATING OLD TURF AREAS . . . . .	245
APPENDIX A	
RECOMMENDED MATERIALS OR EQUIPMENT . . . . .	249
APPENDIX B	
SUGGESTED REFERENCES FOR INSTRUCTIONAL UNITS . . .	255
APPENDIX C	
SELECTED LIST OF PROFESSIONAL AND TECHNICAL SOCIETIES	259

# ORNAMENTAL HORTICULTURE

## THE USE OF THIS CURRICULUM GUIDE

THERE IS LESS THAN FULL AGREEMENT ON JUST WHAT CONSTITUTES A PARTICULAR TYPE OF CURRICULUM DOCUMENT. THE CURRICULUM GUIDE IS NO EXCEPTION. THE FOLLOWING IS NOT MEANT AS AN EFFORT TO DEBATE CURRICULUM TERMINOLOGY FURTHER, BUT RATHER TO CLARIFY HOW THIS DOCUMENT CAN BE USED MORE EFFECTIVELY FOR ITS INTENDED PURPOSE.

ENTITLED A CURRICULUM GUIDE, IT IS DESIGNED TO ANSWER THE MORE BASIC QUESTIONS OF CURRICULUM PLANNING AND DEVELOPMENT - WHAT SHOULD BE TAUGHT, AND TO SOME DEGREE, HOW AND WITH WHAT RESOURCES. IT IS NOT INTENDED TO TEACH FROM, NOR TO BE USED AS INSTRUCTIONAL MATERIAL IN THE CLASS BY EITHER TEACHER OR STUDENTS.

IT IS MEANT AS AN AID TO ALL WHO ARE INVOLVED IN THE CURRICULUM PLANNING PHASES PRIOR TO CLASSROOM INSTRUCTION. FOR ADMINISTRATORS AND OTHERS WHO MUST MAKE DECISIONS CONCERNING FACILITIES OR EQUIPMENT, THERE ARE GUIDELINES TO BOTH SPECIFICATIONS AND OVERALL COST RANGES. FOR GUIDANCE COUNSELORS OR OTHERS WORKING WITH STUDENTS ON CAREER DECISIONS, INFORMATION IS PROVIDED CONCERNING OCCUPATIONS AND THE TYPE OF COMPETENCIES AND CHARACTERISTICS NEEDED BY THE WORKERS FOR THESE OCCUPATIONS. FOR THE CURRICULUM SPECIALIST, TEACHER EDUCATOR, STATE SUPERVISOR, OR OTHERS RESPONSIBLE FOR DETERMINING INSTRUCTIONAL CONTENT AND PREPARING TEACHERS TO CONDUCT INSTRUCTIONAL PROGRAMS, THE GUIDE DEFINES THE NEEDS OF THE STUDENTS IN TERMS OF TERMINAL PERFORMANCES. ALL OTHER ASPECTS OF CURRICULUM CONTENT, TEACHING PROCESSES, AND INSTRUCTIONAL RESOURCES ARE BASED UPON THE TERMINAL PERFORMANCE OBJECTIVES FOR THE STUDENTS.

THE SCOPE OF THE GUIDE INCLUDES FIVE OCCUPATIONAL SUBGROUPS WITHIN THE ORNAMENTAL HORTICULTURE AREA. THESE ARE CONSISTENT WITH AND CODED AS DEFINED IN THE STANDARD TERMINOLOGY FOR CURRICULUM AND INSTRUCTION IN LOCAL AND STATE SCHOOL SYSTEMS. THE OVERALL AREA OF ORNAMENTAL HORTICULTURE IS GIVEN THE DESIGNATION 01.05000000. THE OCCUPATIONAL SUBGROUPS HAVE THE FOLLOWING DESIGNATIONS.

ARBORICULTURE	01.05 01 0000
FLORICULTURE	01.05 02 0000
LANDSCAPING	01.05 04 0000
NURSERY	01.05 05 0000
TURF MANAGEMENT	01.05 06 0000

THE OCCUPATIONS CONSIDERED IN THESE FIVE SUBGROUPS ARE LIMITED TO THOSE ON THE CAREER LADDER FOR WHICH HIGH SCHOOL VOCATIONAL INSTRUCTION IS EITHER NECESSARY OR SIGNIFICANTLY DESIRABLE. THE UNITS WITHIN THE GUIDES ARE BUILT UPON MINIMUM LEVEL OF COMPETENCIES FOR ENTRY LEVEL JOBS. HOWEVER, IT IS ASSUMED THAT EVEN THOUGH STUDENTS MUST BEGIN AT THIS ENTRY LEVEL JOB, MANY WILL SOON BE STRIVING TO ADVANCE. WHENEVER THE EMPLOYEE IS PRESENTED WITH OTHER DESIRABLE JOB OPPORTUNITIES, IT IS INTENDED THAT HIS VOCATIONAL INSTRUCTION WILL HELP HIM MASTER EARLY JOB OPPORTUNITY ADVANCES IN AN EFFICIENT MANNER.

SOME STATES HAVE PROVIDED THAT APPROXIMATELY 2,000 HOURS BE USED DURING THE JUNIOR AND SENIOR YEAR FOR INSTRUCTION, LABORATORY, AND COOPERATIVE ON-THE-JOB EXPERIENCE IN A SPECIALIZED ORNAMENTAL HORTICULTURE PROGRAM. WHILE THIS GUIDE MAY NOT COVER ALL INSTRUCTIONAL SEQUENCES WHICH MAY BE POSSIBLE, THERE IS LIKELY MORE INCLUDED IN THIS GUIDE THAN WOULD BE USED IN ANY ONE PROGRAM INVOLVING 2,000 HOURS. IT IS INTENDED THAT THE USERS OF THIS GUIDE WILL SELECT THOSE INSTRUCTIONAL AREAS TO BUILD AN INSTRUCTIONAL PACKAGE WHICH MOST APPROPRIATELY MEETS THE STUDENT'S NEEDS IN THAT STATE OR LOCALITY.

BECAUSE MANY ORNAMENTAL HORTICULTURE PROGRAMS ACROSS THE COUNTRY ARE SIMILAR, OR AT LEAST HAVE MANY COMMON AREAS IN THE CURRICULUM, CONSIDERABLE REDUNDANCY OF EFFORT OCCURS AS THESE PROGRAMS ARE PLANNED AND DEVELOPED. IN PREPARING THIS GUIDE, A MAJOR CONCERN HAS BEEN TO IDENTIFY THOSE PERFORMANCE OBJECTIVES WHICH ARE COMMON TO ALL OR TO A LARGE PROPORTION OF THE PROGRAMS. THOSE WHICH ARE ONLY APPROPRIATE TO LIMITED LOCALITIES HAVE NOT BEEN INCLUDED.

IT IS INTENDED THAT THE OBJECTIVES STATED IN THIS GUIDE WOULD SAVE TIME AND EFFORT FOR STATE PERSONNEL WHO HAVE THE RESPONSIBILITY FOR DEFINING THE OCCUPATIONAL COMPETENCIES IN ORNAMENTAL HORTICULTURE.

ONCE THE OBJECTIVES FROM THE GUIDE WHICH ARE COMMON TO THE STATE CURRICULUM NEEDS ARE DEFINED, THEY COULD BE USED TO FACILITATE STATING MORE SPECIFIC LEVELS OF OBJECTIVES. OR, IF OTHER OBJECTIVES ARE MORE APPROPRIATE, THEY COULD BE SUBSTITUTED FOR THOSE PRESENTED AS STATE OR LOCAL CONDITIONS WARRANTED.

## ORGANIZATION OF INSTRUCTIONAL UNITS

THIS CURRICULUM GUIDE IS COMPOSED OF UNITS OF INSTRUCTION. EACH UNIT IS DEVELOPED AROUND A CLOSELY RELATED GROUP OF PERFORMANCE OBJECTIVES WHICH ARE BASIC TO THE TRAINING OF INDIVIDUALS FOR ENTRY LEVEL SKILLED EMPLOYMENT IN ORNAMENTAL HORTICULTURE OCCUPATIONS. THE UNITS ARE ORGANIZED INTO FIVE ORNAMENTAL HORTICULTURE OCCUPATIONAL AREAS OF ARBORICULTURE, FLORICULTURE, LANDSCAPING, NURSERY PRODUCTION AND TURFGRASS.

THE READER WILL NOTE THAT THERE IS SOME DUPLICATION OF UNITS FROM ONE ORNAMENTAL HORTICULTURE AREA TO ANOTHER. THE REASON FOR THIS DUPLICATION IS BASED UPON THE ASSUMPTION THAT MANY HORTICULTURE PROGRAMS NOW IN EXISTENCE DO NOT DEAL WITH ALL FIVE OCCUPATIONAL AREAS AS DEFINED IN THIS GUIDE. RATHER, THEY MAY BE CONCERNED WITH IN-DEPTH INSTRUCTION IN ONE OR TWO OCCUPATIONAL AREAS, SUCH AS NURSERY PRODUCTION OR FLORICULTURE. WHERE COMPREHENSIVE PROGRAMS DO EXIST, THE USER WILL OF COURSE NOTE THESE DUPLICATIONS AND ARRANGE THEIR COURSE(S) OF STUDY ACCORDINGLY.

THE INSTRUCTIONAL UNITS ARE BASED UPON THE COMPETENCIES OF ENTRY LEVEL SKILLED OCCUPATIONS IN ORNAMENTAL HORTICULTURE. MOST OF THE PERFORMANCE OBJECTIVES FOR THE UNITS ARE COMMON TO ORNAMENTAL HORTICULTURE PROGRAMS.

## FORMAT OF THE UNITS OF INSTRUCTION

EACH OF THE UNITS OF INSTRUCTION HAS SEVEN ELEMENTS TO BE USED FOR DEVELOPING SPECIFIC CURRICULUM AND CURRICULUM MATERIALS. THE LIST OF ELEMENTS INCLUDES:

1. UNIT CONCEPT
2. STUDENT PERFORMANCE OBJECTIVES
3. INSTRUCTIONAL AREAS
4. EXAMPLES OF STUDENT LEARNING ACTIVITIES
5. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE
6. INSTRUCTIONAL MATERIALS OR EQUIPMENT
7. EXAMPLES OF SUPPORTING REFERENCES

### A DESCRIPTION OF THE SEVEN ELEMENTS OF THE UNITS OF INSTRUCTION

#### UNIT CONCEPT

THE UNIT CONCEPT DEFINES THE RATIONALE FOR THE AREA COVERED BY THE INSTRUCTIONAL UNIT.

#### STUDENT PERFORMANCE OBJECTIVES

THE STUDENT PERFORMANCE OBJECTIVES HAVE BEEN CONSIDERED THE BASIC ELEMENT OF THE UNITS OF INSTRUCTION. ALL OTHER ELEMENTS ARE DEVELOPED FROM THE PERFORMANCE OBJECTIVES. THE OBJECTIVES ARE STATED IN STUDENT TERMS AT A TERMINAL PERFORMANCE LEVEL.

THE TERMINAL PERFORMANCES HAVE BEEN DEFINED FROM AN ANALYSIS OF COMPETENCIES NECESSARY FOR SUCCESSFUL PERFORMANCE IN THE ENTRY LEVEL SKILLED OCCUPATIONS OF ORNAMENTAL HORTICULTURE.

THE PERFORMANCE OBJECTIVES OF THE GUIDE ARE INTENDED TO AID CURRICULUM SPECIALISTS AND TEACHERS OF LOCAL ORNAMENTAL HORTICULTURE PROGRAMS IN DEFINING THE COMPETENCIES WHICH CAN AND SHOULD BE ACQUIRED BY STUDENTS IN LOCAL PROGRAMS.

IT WAS FELT THAT COMPETENT TEACHERS OF A VOCATIONAL PROGRAM WOULD BE IN THE BEST POSITION TO ESTABLISH 'HOW WELL' THE OBJECTIVE SHOULD BE PERFORMED, AND THE CONDITIONS UNDER WHICH IT SHOULD BE PERFORMED. HOWEVER, CONDITIONS AND STANDARDS HAVE BEEN INDICATED FOR MOST OBJECTIVES. THE INTENT IS TO DIRECT ATTENTION TO THOSE CONDITIONS WHICH MAY SIGNIFICANTLY AFFECT ACHIEVING THE PERFORMANCE AND IDENTIFY STANDARDS WHICH MAY BE ESPECIALLY IMPORTANT TO SUCCESS IN THE INDUSTRY.

### INSTRUCTIONAL AREAS

THE PERFORMANCE OBJECTIVES ARE DESCRIPTIONS OF INTENDED OUTCOMES WHICH REQUIRE THE ACQUISITION OF CERTAIN KNOWLEDGE AND SKILLS. TITLES AND SUBTITLES OF INSTRUCTIONAL AREAS ARE USED TO DEFINE THE RELEVANT CONTENT.

THE TITLES ARE PRESENTED IN AN ACTION FORM AS FAR AS FEASIBLE TO HELP DEFINE THE SPECIFIC TYPE OF LEARNING EXPECTED TO ACHIEVE THE OBJECTIVES. THAT IS, IN DEFINING STUDY AREAS CONCERNING PLANTING MEDIA, RATHER THAN LIMITING THE TITLE BY USING "PLANTING MEDIA," THE STUDY AREAS OF "SELECTING PLANTING MEDIA," AND "MIXING PLANTING MEDIA" ARE USED. THE "-ING" OR GERUND VERB FORM OF THE TITLE IS TO AID IN MORE SPECIFICALLY DEFINING THE COMPETENCIES TO BE BROUGHT OUT IN THE LEARNING PROCESSES.

BECAUSE OF THE SPECIFIC NATURE OF MUCH OF THE LEARNING MATERIALS NEEDED FOR THESE INSTRUCTIONAL AREAS, REFERENCES ARE CITED WHICH WOULD BE APPROPRIATE FOR CURRICULUM DEVELOPERS. THE TITLES FOR THE INSTRUCTIONAL AREAS ARE OF A RELATIVELY PERMANENT NATURE AND COMMON TO MOST PROGRAMS. THE SPECIFIC CONTENT TO SUPPORT THEM IS MUCH MORE ADVERSELY AFFECTED BY CHANGES IN TECHNOLOGY, GEOGRAPHIC DIFFERENCES OR DIFFERENCES IN LOCAL OCCUPATIONAL CHARACTERISTICS.

IT MAY BE POSSIBLE TO USE THE SUGGESTED TITLES OVER A PERIOD OF TIME WITH RELATIVELY MINOR ADJUSTMENTS. SPECIFIC CONTENT, ON THE OTHER HAND, NEEDS TO BE CONTINUALLY UPDATED TO CURRENT CONDITIONS AND MATCHED WITH LOCAL STUDENT NEEDS AND OCCUPATIONAL CHARACTERISTICS.

THE NUMBERING OF THE INSTRUCTIONAL AREA TITLES ARE NOT MATCHED TO THE NUMBERS OF THE STUDENT PERFORMANCE OBJECTIVES. HOWEVER, INSTRUCTIONAL AREAS RELATING TO AN OBJECTIVE CAN BE DETERMINED RELATIVELY EASILY. THE INSTRUCTIONAL AREAS ARE SEQUENCED AS MUCH AS IS FEASIBLE, IN THE SAME ORDER AS THE PERFORMANCE OBJECTIVES TO WHICH THEY RELATE.



## EXAMPLES OF STUDENT LEARNING ACTIVITIES

EXAMPLES ARE PROVIDED SUGGESTING WAYS IN WHICH STUDENTS MAY BE ACTIVELY INVOLVED IN LEARNING ACTIVITIES THAT WOULD HELP THEM ACHIEVE THE OBJECTIVES. THEY ARE SUGGESTED AS ONE APPROACH THAT MAY BE USED RATHER THAN INTENDED TO BE THE COMPLETE LIST OF ACTIVITIES WHICH WOULD PROVIDE THE MOST EFFECTIVE LEARNING. THE SUGGESTED ACTIVITIES FOR EACH OBJECTIVE MAY OR MAY NOT COVER THE ENTIRE OBJECTIVE. THEREFORE, DEVELOPMENT OF OTHER ACTIVITIES FOR THE LOCAL PROGRAM WILL BE NECESSARY FOR A COMPREHENSIVE PROGRAM.

THERE IS AT LEAST ONE ACTIVITY FOR EACH STUDENT PERFORMANCE OBJECTIVE. THE NUMBER ON THE ACTIVITY IS THE SAME AS THE STUDENT PERFORMANCE OBJECTIVE TO WHICH IT IS RELATED.

## EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

THE STUDENT EVALUATION SHOULD BE DIRECTED TOWARD AND BASED UPON WELL WRITTEN STUDENT PERFORMANCE OBJECTIVES. IN THIS GUIDE THE STUDENT PERFORMANCE OBJECTIVES ARE INTENDED TO BE EXPLICITLY STATED IN WHAT TERMINAL PERFORMANCE THE STUDENT IS TO BE ABLE TO DO, AND TO SOME DEGREE, HOW WELL AND UNDER WHAT CONDITIONS. PRIMARILY, THE EVALUATION IS TO USE THE STATED OBJECTIVES AS A REFERENCE POINT TO ANSWER THE QUESTION -- CAN THE STUDENT ACHIEVE THE DESIRED PERFORMANCE LEVEL?

IN ADDITION, AN ELEMENT DESIGNATED AS "EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE" IS INCLUDED IN EACH UNIT OF INSTRUCTION. EXAMPLES OF EVALUATION PROCESSES ARE INTENDED TO ASSIST IN DETERMINING THE LEVEL OF UNDERSTANDING OF THE ABILITY OF THE STUDENT TO ACCOMPLISH PARTS OF OR THE ENTIRE PERFORMANCE OBJECTIVE. IN NO WAY ARE THESE PROCESSES INTENDED TO REPLACE A DIRECT EVALUATION OF THE TERMINAL PERFORMANCE AS STATED IN THE OBJECTIVE.

THE TYPE OF EVALUATION PROCESS IS DETERMINED IN PART BY THE NATURE OF THE PERFORMANCE OBJECTIVES. BUT THE MOST DESIRABLE METHOD CAN BE BEST DETERMINED WHEN THERE IS KNOWLEDGE OF THE LOCAL SITUATION, SUCH AS EDUCATIONAL RESOURCES, SCHOOL POLICIES AND THE NEEDS OF THE STUDENTS.

THERE IS AT LEAST ONE EVALUATION PROCESS FOR EACH STUDENT PERFORMANCE OBJECTIVE. THE NUMBER ON THE EVALUATION ACTIVITY IS THE SAME AS THE STUDENT PERFORMANCE OBJECTIVE TO WHICH IT IS RELATED.

## INSTRUCTIONAL MATERIALS OR EQUIPMENT

MATERIALS OR EQUIPMENT ARE NOTED WHICH ARE SPECIFIC TO THE UNIT AND WHICH ARE CONSIDERED ESSENTIAL OR QUITE DESIRABLE IN THE LEARNING PROCESS. IN SOME CASES, THE OBJECTIVES WOULD BE QUITE DIFFICULT TO ACHIEVE, IF AT ALL, WITHOUT THE MATERIALS. IN OTHERS, THE MATERIALS OR EQUIPMENT AID IN THE EFFECTIVENESS OR EFFICIENCY OF LEARNING.

THE MATERIALS AND EQUIPMENT SUGGESTED FOR ONE UNIT ARE NOT NECESSARILY CONSUMED OR UNIQUE JUST TO THE LEARNING ACTIVITIES OF THAT UNIT. A LIST OF THE EQUIPMENT SUGGESTED FOR A COMPREHENSIVE ORNAMENTAL HORTICULTURE PROGRAM IS LISTED IN APPENDIX A.

### EXAMPLES OF SUPPORTING REFERENCES

A LIMITED NUMBER OF REFERENCES HAS BEEN LISTED WHICH DIRECTLY RELATE TO THE CURRICULUM STUDY AREAS SUGGESTED IN THE "INSTRUCTIONAL AREAS" SECTION. THESE REFERENCES ARE AVAILABLE AND THE SOURCE OR DETAILS OF SECURING THEM IS LOCATED IN APPENDIX B OF THIS GUIDE.

WHEN TWO OR MORE REFERENCES ARE FOUND TO HAVE ADEQUATE LEARNING MATERIALS AND PROCESSES FOR THE OBJECTIVES OF A UNIT BUT HAVE UNIQUELY DIFFERENT STYLES, THE GROUP MAY BE LISTED SO THAT THE TEACHER HAS THE CHOICE OF SELECTING THE ONE MOST SUITED TO HIS TEACHING.

IN SOME CASES, SEVERAL REFERENCES ARE NOTED BECAUSE NO ONE REFERENCE ADEQUATELY COVERS ALL OF THE OBJECTIVES OF A UNIT OR STUDY AREA. ANNOTATIONS OF THE REFERENCES ARE PROVIDED TO AID IN DETERMINING WHICH REFERENCE OR REFERENCES WOULD BE BEST SUITED FOR A LOCAL PROGRAM. THE REFERENCE SUGGESTED FOR ONE UNIT IS OFTEN RELEVANT AND SUGGESTED FOR USE IN SEVERAL OF THE UNITS. IN NO WAY SHOULD THE REFERENCES BE CONSIDERED THE BEST OR ONLY REFERENCES TO BE USED WITH THE UNITS.

## RECOMMENDED FACILITIES AND EQUIPMENT

### SUGGESTIONS FOR PLANNING THE FACILITIES FOR ORNAMENTAL HORTICULTURE PROGRAMS

THE NATURE AND THE EXTENT OF THE FACILITIES NEEDED FOR ORNAMENTAL HORTICULTURAL INSTRUCTION WILL BE INFLUENCED BY THE PROJECT ENROLLMENTS AND PLANNED USE OF THE FACILITIES BY CONTINUING EDUCATION AND OTHER GROUPS, AND THE EMPHASES TO BE INCLUDED IN THE COURSE OF STUDY. THE SUGGESTIONS WHICH FOLLOW ARE TO BE CONSIDERED ONLY AS GUIDES FOR SCHOOL FACILITY PLANNERS AND ARCHITECTS.

### SPACE ALLOCATIONS

RECOMMENDED MINIMUM SPACE ALLOCATIONS FOR ACCOMMODATING TWENTY STUDENTS PER SECTION INCLUDE:

CLASSROOM - 720 SQUARE FEET  
 SHOP AND LABORATORY - 1200 SQUARE FEET  
 GREENHOUSE - 3000 SQUARE FEET  
 HEADHOUSE - 800 SQUARE FEET (ADDITIONAL TO THE GROWING  
 SPACE IN THE GREENHOUSE)  
 LAND LABORATORY - ACCESS TO ABOUT 5 ACRES



## THE GREENHOUSE

THE MATERIALS SELECTED FOR USE IN CONSTRUCTING THE GREENHOUSE WILL DEPEND LARGELY UPON THE CROPS TO BE GROWN IN IT OR THE USES TO BE MADE OF IT IN THE TEACHING PROGRAM. IF IT IS TO BE USED PRIMARILY FOR THE PRODUCTION OF CUT FLOWERS AND/OR POTTED PLANTS, THE STRUCTURE SHOULD PROBABLY BE COVERED WITH GRASS. IF, ON THE OTHER HAND, IT IS TO BE USED ESSENTIALLY FOR THE PROPAGATION OF WOODY PLANT MATERIALS, WHICH MAY BE THE CASE IN A PROGRAM WHERE THE NURSERY AND LANDSCAPING AREAS ARE EMPHASIZED, THEN PLASTIC COVERINGS MAY SUFFICE. PLANS AND SPECIFICATIONS FOR CONSTRUCTING GLASS-COVERED GREENHOUSES ARE AVAILABLE FROM GREENHOUSE MANUFACTURING FIRMS.

IN PLANNING PLASTIC-COVERED STRUCTURES, A VARIETY OF MATERIALS ARE AVAILABLE FOR COVERING. POLYETHYLENE IN 4- OR 6-MIL THICKNESS IS AVAILABLE IN SEAMLESS WIDTHS UP TO 40 FEET. POLYETHYLENE, WHILE INEXPENSIVE, MUST BE REPLACED EACH YEAR. VINYL FILMS ARE AVAILABLE IN THICKNESSES FROM 4- TO 12-MILS AND DO NOT HAVE TO BE REPLACED AS OFTEN, BUT ARE AVAILABLE ONLY IN WIDTHS UP TO ABOUT 72 INCHES. RIGID MATERIALS SUCH AS FIBERGLASS AND POLYVINYL CHLORIDE SHOULD BE CONSIDERED, AS THEIR LIMITED USE THUS FAR IN SCHOOL-OPERATED STRUCTURES SHOWS PROMISE.

TECHNICAL DETAILS WHICH NEED TO BE CONSIDERED IN ADDITION TO THOSE MENTIONED ABOVE INCLUDE:

- LOCATION ON THE SITE TO MAKE MAXIMUM UTILIZATION OF AVAILABLE LIGHT
- PROVIDING ADEQUATE TEMPERATURE
- PROVIDING FOR ADEQUATE COOLING AND VENTILATION
- PROVIDING ARTIFICIAL LIGHTING
- PROVIDING SOIL AND AIR MOISTURE
- PROVIDING TWO OR MORE ENVIRONMENTAL CLIMATES
- PROVIDING FOR FUTURE EXPANSION

## GREENHOUSE SYSTEMS

HEATING - A HOT WATER SYSTEM IS MOST DESIRABLE BUT STEAM, GAS OR ELECTRICITY MAY BE USED. IF THE HEATING UNIT IS ATTACHED TO THE MAIN PLANT SYSTEM, AN AUXILIARY UNIT SHOULD BE PROVIDED TO COMPENSATE FOR LOWER HEAT TEMPERATURES DURING WEEKENDS AND HOLIDAY PERIODS.

VENTILATION AND COOLING - EITHER A THERMOSTATICALLY-CONTROLLED VENTILATION OR A REFRIGERATED COOLING SYSTEM SHOULD BE PROVIDED. AUTOMATIC CONTROLS WILL GREATLY ENHANCE THE CONTROL OF ENVIRONMENTAL FACTORS WHEN THE GREENHOUSE IS UNATTENDED.

WATER - A WATER MAIN OF SUFFICIENT SIZE SHOULD BE PROVIDED TO ACCOMMODATE INSTALLATION OF AN AUTOMATIC WATERING SYSTEM. THERE MAY BE A NEED FOR AN AUTOMATICALLY-OPERATED MISTING SYSTEM.

ELECTRICITY - ELECTRIC SERVICE OF SUFFICIENT VOLTAGE TO OPERATE A SOIL STERILIZING UNIT AND OTHER ELECTRICAL EQUIPMENT SHOULD BE PROVIDED. A SUFFICIENT NUMBER OF 110-VOLT WATERPROOF DUPLEX OUTLETS SHOULD BE PROVIDED (ONE PER TEN LINEAR FEET OF WALL SPACE).

SOIL STERILIZER - A 220-VOLT, ONE-EIGHTH CUBIC YARD SOIL STERILIZER IS RECOMMENDED. STEAM OR CHEMICAL SOIL STERILIZATION METHODS MAY PROVE SATISFACTORY.

### THE LAND LABORATORY

ACCESS SHOULD BE PROVIDED TO AT LEAST FIVE ACRES OF LAND FOR THE DEVELOPMENT OF THE FOLLOWING AREAS WHICH MAY BE APPROPRIATE;

NURSERY AREA  
 ARBORETUM  
 TURF DEMONSTRATION PLOTS AND SODDED AREAS  
 STUDENT PRACTICE PLOTS AND GARDENS  
 OTHERS

IT IS DESIRABLE THAT THIS LABORATORY BE LOCATED AS CLOSE TO THE SCHOOL BUILDINGS AS POSSIBLE. IT SHOULD BE ESTABLISHED ON REASONABLY GOOD SOIL AND, IF POSSIBLE, PROTECTED BY FENCING.

### THE MECHANICS LABORATORY

SUITABLE FACILITIES SHOULD BE PROVIDED SO THAT PUPILS WILL HAVE AN APPROPRIATE PLACE TO WORK ON SMALL GAS ENGINES, LARGER POWER UNITS, FIELD AND GARDEN POWER EQUIPMENT - INCLUDING MAINTAINING AND STORING THESE ITEMS - AS WELL AS SMALL SHOP AND FIELD HAND TOOLS. THE LABORATORY AREA SHOULD HAVE A CONCRETE FLOOR, AT LEAST A 10-FOOT WIDE OVERHEAD DOOR AND ADEQUATE LIGHTING, VENTILATION AND HEATING. IT ALSO SHOULD BE PROVIDED WITH APPROPRIATE BENCHES, TOOL CABINETS AND OTHER FURNITURE.

A CAREFUL CONSIDERATION OF THE SUGGESTED COURSE OF STUDY RELATING TO THE MECHANICS AREAS AND THE TOOL AND EQUIPMENT CHECKLISTS INCLUDED IN THIS PUBLICATION WILL PROVIDE ADDITIONAL GUIDELINES IN DEVELOPING PLANS FOR THE MECHANICS LABORATORY.

### THE CLASSROOM

THE CLASSROOM SHOULD BE EQUIPPED WITH TABLES AND CHAIRS TO ACCOMMODATE 25 STUDENTS, A TACK BOARD, A CHALK BOARD, A TEACHER'S WORK BENCH AND SINK AND OFFICE EQUIPMENT, SUCH AS DESK, CHAIRS AND FILING CABINETS.

CONSIDERATION SHOULD BE GIVEN TO PROVIDING COMBINATION STUDENT TABLES WITH EITHER A FULL OR PARTIAL TILTING TOP WHICH WILL PROVE USEFUL IN THE LANDSCAPE DRAWING PHASES OF THE INSTRUCTIONAL PROGRAM.

EQUIPMENT AND FURNITURE REQUIRED FOR TEACHING THE MERCHANDISING PHASES OF THE PROGRAM SHOULD BE PROVIDED. THESE MAY BE INCLUDED IN THE ORNAMENTAL HORTICULTURE CLASSROOM WHERE COURSES IN AGRICULTURAL BUSINESS ARE NOT OFFERED. THEY MAY ALSO BE APPROPRIATELY INCLUDED IN THE CLASSROOM LABORATORY PROVIDED FOR AGRICULTURAL BUSINESS INSTRUCTION WHERE THESE COURSES ARE INCLUDED IN THE AGRICULTURAL OFFERINGS.

### THE HEADHOUSE

THE HEADHOUSE CAN BE CONSTRUCTED AT ONE END OF THE GREENHOUSE. IT SHOULD BE EQUIPPED WITH STUDENT WORK BENCHES, A SINK, A HORTICULTURAL REFRIGERATOR, A SOIL STERILIZER AND SUITABLE STORAGE SHELVES, BINS, ETC., FOR POTS AND OTHER CONTAINERS, SOIL AND OTHER PLANT GROWING MEDIA AND OTHER SUPPLIES. THIS FACILITY WILL BE USED FOR SOIL PREPARATION, TRANSPLANTING, POTTING, HARDENING OF PLANTS AND STORAGE.

### OTHER FACILITIES REQUIREMENTS

OTHER FACILITIES NEEDS MAY INCLUDE:

- A TEACHER'S OFFICE
- LOCKER SPACE
- COLD FRAMES
- ADDITIONAL STORAGE SPACE FOR LARGE AND SMALL EQUIPMENT, SUPPLIES, COMBUSTIBLES, OTHER HAZARDOUS MATERIALS AND FIRE PREVENTION AND CONTROL APPARATUS
- A 500- TO 1000-SQUARE FOOT PLASTIC GREENHOUSE
- A 20-FOOT X 30-FOOT LATH HOUSE (PIPE FRAME COVERED WITH SNOW FENCE)

### SUGGESTIONS FOR DEVELOPING LISTS OF NEEDED EQUIPMENT AND SUPPLIES

THE TYPE AND QUANTITIES OF EQUIPMENT AND SUPPLIES REQUIRED TO PROVIDE EFFECTIVE OCCUPATIONAL EDUCATION IN ORNAMENTAL HORTICULTURE WILL DEPEND ON SEVERAL FACTORS. THESE INCLUDE: THE ANTICIPATED SIZES OF THE GROUPS TO BE SERVED; THE TYPES OF GROUPS TO BE SERVED, FOR EXAMPLE SECONDARY OR ADULT; THE EMPHASIS TO BE INCLUDED IN THE COURSE OF STUDY IN TERMS OF THE DIVERSIFICATION OR SPECIALIZATION, AND OTHER FACTORS.

THE OPTIMUM CLASS SIZE IS CONSIDERED, FOR PLANNING PURPOSES, TO BE ABOUT 25 PUPILS. SUFFICIENT QUANTITIES OF TOOLS, EQUIPMENT AND SUPPLIES SHOULD BE PROVIDED TO MAKE MAXIMUM USE OF THE TIME AVAILABLE FOR LABORATORY AND PRACTICAL EXERCISES. THIS WILL NOT REQUIRE NECESSARILY THAT 25 DUPLICATES OF A SPECIFIC ITEM WILL BE NEEDED AS PROPER MANAGEMENT OF PRACTICAL SITUATIONS WILL SELDOM RESULT IN EACH PUPIL USING THE IDENTICAL ITEM AT THE SAME TIME.

PROVISION SHOULD BE MADE, WHEN IT IS POSSIBLE TO DO SO, TO PURCHASE SEVERAL DIFFERENT BRANDS OF THE SAME ITEM. THIS WILL PROVIDE OPPORTUNITIES FOR PUPILS TO BECOME FAMILIAR WITH THE PRODUCTS OF COMPETING MANUFACTURERS, RATHER THAN JUST ONE.

AN ADVISORY COMMITTEE COMPOSED OF REPRESENTATIVES OF LOCAL SEGMENTS OF THE ORNAMENTAL HORTICULTURE INDUSTRY CAN PROVIDE INVALUABLE ASSISTANCE IN DEVELOPING LISTS OF NEEDED EQUIPMENT AND SUPPLIES.

BECAUSE INSTRUCTION IN HORTICULTURAL MECHANICS SKILLS IS RECOMMENDED AS A PART OF THE TOTAL PROGRAM, IT WILL BE NECESSARY TO PROVIDE TOOLS AND EQUIPMENT TO OUTFIT THE HORTICULTURAL MECHANICS LABORATORY. THE TYPES AND NUMBERS OF SUCH ITEMS TO BE PURCHASED WILL BE DEPENDENT UPON THEIR AVAILABILITY IN OTHER OCCUPATIONAL PROGRAMS AT THE SCHOOL OR AREA OCCUPATIONAL EDUCATION CENTER.

FOR PLANNING PURPOSES, ABOUT \$25,000 SHOULD BE BUDGETED TO PROVIDE THE NECESSARY EQUIPMENT FOR A COMPREHENSIVE PROGRAM IN ORNAMENTAL HORTICULTURE. THIS FIGURE INCLUDES HEAVY EQUIPMENT ITEMS, SUCH AS A 3/4 TON TRUCK AND AN ALL-PURPOSE TRACTOR, WHICH ARE REQUIRED FOR INSTRUCTIONAL SITUATIONS IN THE LAND LABORATORY. APPROXIMATELY \$1,000 SHOULD BE BUDGETED FOR THE INITIAL SUPPLIES.

## TEACHER REQUIREMENTS AND RESPONSIBILITIES

IN ORDER FOR AN ORNAMENTAL HORTICULTURE CURRICULUM TO BE EFFECTIVE, THE TEACHING STAFF MUST BE COMPETENT AND ENTHUSIASTIC. THE SPECIALIZED NATURE OF THE CURRICULUM REQUIRES THAT THE TEACHER(S) HAVE COMPETENCIES IN PRODUCING, USING, AND MARKETING ORNAMENTAL PLANTS, GAINED THROUGH EXPERIENCE AND SPECIALIZED TRAINING IN ORNAMENTAL HORTICULTURE.

THE TEACHER(S) SHOULD UNDERSTAND THE EDUCATIONAL PHILOSOPHY, THE OBJECTIVES AND THE SPECIFIC REQUIREMENTS OF THE PROGRAM. THEY WILL NEED TO BE ABLE TO ORGANIZE AND DEVELOP PROGRAMS FOR EACH INDIVIDUAL SO THAT HE MEETS THE REQUIREMENTS OF THE OCCUPATIONAL CLUSTER(S) THAT HE IS PREPARING TO ENTER.

TEACHERS SHOULD BE CERTIFIED ON THE BASIS OF COMPLETION OF A DEGREE IN AGRICULTURAL EDUCATION WITH SPECIALIZATION IN HORTICULTURE AND THIS CERTIFICATION SHOULD ALSO REQUIRE A PERIOD OF OCCUPATIONAL EXPERIENCE IN ORNAMENTAL HORTICULTURE. HOWEVER, BECAUSE OF THE SHORTAGE OF FULLY CERTIFIED PERSONNEL, IT MAY BE NECESSARY TO EMPLOY PERSONS WHOSE TECHNICAL COMPETENCE HAS BEEN DEVELOPED THROUGH OCCUPATIONAL EXPERIENCE IN ORNAMENTAL HORTICULTURE. THESE PERSONS SHOULD BE CERTIFIED WITH THE STIPULATION THAT THEY COMPLETE A PLANNED IN-SERVICE EDUCATION PROGRAM DESIGNED TO DEVELOP PROFESSIONAL COMPETENCIES DESIRED OR NECESSARY FOR FULL CERTIFICATION.

## RESPONSIBILITIES OF THE TEACHER(S) INCLUDES:

1. PLANNING A PROGRAM OF ORNAMENTAL HORTICULTURE INCLUDING WORKING WITH ADVISORY COMMITTEES AND DEVELOPING A CURRICULUM TO FIT LOCAL NEEDS
2. TEACHING CLASSES
3. SUPERVISING OCCUPATIONAL EXPERIENCE PROGRAMS
4. SELECTING AND UTILIZING FACILITIES AND EQUIPMENT
5. ADVISING YOUTH ORGANIZATIONS
6. INFORMING THE PUBLIC OF PROGRAM, ACTIVITIES AND STUDENTS' RESOURCES
7. UTILIZING COMMUNITY RESOURCES
8. PROVIDING SAFETY INSTRUCTION AND PRACTICES
9. GUIDING AND COUNSELING STUDENTS
10. PLACEMENT AND FOLLOW-UP OF STUDENTS

MOTIVATION AND MORALE BUILDING SHOULD BE A PART OF EVERY CLASS AND LABORATORY PERIOD. IT IS SUGGESTED THAT THE INSTRUCTOR MAKE AN EFFORT EARLY IN THE PROGRAM TO ESTABLISH AN ENVIRONMENT WHICH WILL HEIGHTEN AND MAINTAIN THE STUDENT'S INTEREST. THE SUCCESS OF THE PROGRAM CAN BE JUDGED PRIMARILY BY THE NUMBER OF STUDENTS WHO REMAIN GAINFULLY EMPLOYED IN CAREERS WHICH WOULD OTHERWISE NOT HAVE BEEN AVAILABLE TO THEM.

## SCIENTIFIC AND TECHNICAL SOCIETIES AND TRADE ASSOCIATIONS

SCIENTIFIC AND TECHNICAL SOCIETIES, COMMERCIAL FIRMS, AND TRADE GROUPS ARE AN IMPORTANT SOURCE OF INSTRUCTIONAL MATERIALS AND OTHER BENEFITS FOR TEACHERS AND STUDENTS. THE SOCIETIES, IN THEIR PUBLICATIONS AND AT MEETINGS, PROVIDE CONTINUAL EXPOSURE TO THE MOST RECENT DEVELOPMENTS IN THE SCIENCE AND RELATED TECHNOLOGIES AND PROBABLY SERVE AS THE BEST MEANS FOR HELPING PERSONS KEEP UP-TO-DATE IN A PARTICULAR PHASE OF THE SCIENCE.

LESS CONSPICUOUS, BUT EXTREMELY IMPORTANT, IS THE SUPPORT WHICH SOCIETIES MAY GIVE: (1) IN HELPING TO DEVELOP EVIDENCE OF THE NEED FOR THE TRAINING PROGRAM; (2) IN HELPING TO PROMOTE THE PROGRAM; (3) IN ENLISTING MEMBERS' SUPPORT FOR THE PROGRAM; (4) IN HELPING TO PROVIDE WORK EXPERIENCE FOR STUDENTS; AND (5) IN HELPING WITH THE PLACEMENT OF GRADUATES.



ASSOCIATIONS AND SOCIETIES MAY SUPPLY RESOURCE PEOPLE TO SPEAK TO CLASSES. THEY MAY ALSO SERVE AS HOSTS TO STUDENT GROUPS ON FIELD TRIPS TO STUDY SPECIFIC PHASES OF THE INDUSTRY.

THE FOLLOWING IS A SELECTED LISTING OF SOME OF THE ORGANIZATIONS AND ASSOCIATIONS WHICH ARE PERTINENT TO ORNAMENTAL HORTICULTURE:\*

AMERICAN ASSOCIATION OF BOTANICAL GARDENS AND ARBORETUMS  
 AMERICAN ASSOCIATION OF NURSEYMEN, INCORPORATED  
 AMERICAN FORESTRY ASSOCIATION  
 AMERICAN HORTICULTURAL SOCIETY  
 AMERICAN INSTITUTE OF PARK EXECUTIVES, INCORPORATED  
 AMERICAN RHODODENDRON SOCIETY  
 AMERICAN ROSE SOCIETY  
 AMERICAN SEED TRADE ASSOCIATION  
 AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE  
 AMERICAN SOCIETY OF LANDSCAPE ARCHITECTS  
 HOLLY SOCIETY OF AMERICA  
 INTERNATIONAL PLANT PROPAGATOR'S SOCIETY  
 INTERNATIONAL SHADE TREE CONFERENCE  
 MEN'S GARDEN CLUBS OF AMERICA  
 NATIONAL ARBORIST ASSOCIATION  
 NATIONAL ASSOCIATION OF GARDENERS  
 NATIONAL LANDSCAPE NURSEYMEN'S ASSOCIATION  
 NATIONAL PARKS ASSOCIATION  
 SOCIETY OF AMERICAN FLORISTS  
 SOCIETY OF AMERICAN FORESTERS  
 WOMEN'S NATIONAL FARM AND GARDEN ASSOCIATION

## EMPLOYMENT OPPORTUNITIES IN ORNAMENTAL HORTICULTURE

A GENERALLY ACCEPTED DEFINITION OF ORNAMENTAL HORTICULTURE, INCLUDING FLORICULTURE, IS THE ART, SCIENCE AND BUSINESS INVOLVED IN THE COMMERCIAL PRODUCTION, MAINTENANCE, MARKETING AND USE OF FLORAL CROPS, GARDEN FLOWERS, EVERGREEN AND DECIDUOUS SHRUBS AND TREES.

EMPLOYMENT OPPORTUNITIES IN ORNAMENTAL HORTICULTURE OCCUPATIONS ARE PLENTIFUL WITH MANY OF THE JOBS GOING UNFILLED EACH YEAR. PERSONS QUALIFIED AND WILLING TO PREPARE FOR CAREERS IN THIS FIELD HAVE ALMOST UNLIMITED OPPORTUNITIES. TYPICAL OCCUPATIONS FOR PERSONS COMPLETING THE COURSE OUTLINED IN THIS GUIDE INCLUDE:

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SEE APPENDIX C FOR A COMPLETE ADDRESS OF THESE ORGANIZATIONS AND ASSOCIATIONS.

MAJOR OCCUPATIONAL GROUP	ENTRY LEVEL SKILLED OCCUPATION:	D.O.T. No.:
ARBORICULTURE	ARBORETUM WORKER	404.884
	TREE TRIMMER	959.884
	TREE PRUNER	404.884
	TREE SERVICE WORKER	409.181
	TREE SURGEON ASSISTANT	409.884
FLORICULTURE	FLORAL DESIGNER	142.081
	FLOWER GROWER	406.181
	FLORIST SALESMAN	260.458
	GREENHOUSE WORKER	406.887
LANDSCAPING	LANDSCAPE WORKER	406.887
	LANDSCAPE NURSERY WORKER	406.168
	LANDSCAPE GARDENER	406.181
	PARK EMPLOYEE	407.884
NURSERY	NURSERY WORKER	406.887
	NURSERY SALESMAN	277.358
	GARDEN CENTER WORKER	406.887
TURF	GREENS WORKER	407.884
	GOLF COURSE EMPLOYEE	407.884
	TURFGRASS MAINTENANCE FOREMAN	899.133

SOME MORE DEFINITIVE DESCRIPTIONS OF TYPICAL ENTRY LEVEL JOBS ARE FOUND IN THE FOLLOWING SECTION.

IN ESTABLISHING AN EDUCATIONAL PROGRAM IN ORNAMENTAL HORTICULTURE, THE SCHOOL SHOULD CONSIDER THE EMPLOYMENT OPPORTUNITIES IN THE FIELD, BOTH LOCALLY AND IN NEARBY COMMUNITIES, FOR THE YOUTH AND ADULTS WHO WILL COMPLETE THE PROGRAM. THE COURSES OFFERED SHOULD BE THOSE AREAS OF ORNAMENTAL HORTICULTURE IN WHICH THE GREATEST OPPORTUNITIES FOR EMPLOYMENT ARE FOUND.

#### JOB TITLE - GREENHOUSE WORKER

##### JOB DESCRIPTION

A GREENHOUSE WORKER GROWS PLANTS IN AN ARTIFICIALLY-HEATED CLASS OR PLASTIC GREENHOUSE. THE PLANTS GROWN MAY BE VEGETABLES OR FLOWERS, AND THE WORK MAY INCLUDE THE PROPAGATION OF TREES OR ORNAMENTAL SHRUBS FROM SEEDS OR CUTTINGS. GREENHOUSE SPECIALITIES INCLUDE PRODUCING OUT-OF-SEASON VEGETABLES SUCH AS TOMATOES, CUCUMBER OR LEAF LETTUCE, PRODUCING CUT FLOWERS OR POT PLANTS, GROWING BEDDING PLANTS FOR SALE OR STARTING PLANTS FOR OUTDOOR NURSERY BEDS. IN MANY CASES, A GREENHOUSE IS A PART OF A NURSERY OPERATION. IN SUCH CASES, A WORKER MAY BE PERFORMING THE DUTIES OF A NURSERY WORKER AS WELL AS THOSE OF A GREENHOUSE WORKER. AN



EMPLOYEE IN THE GREENHOUSE SCREENS, MIXES, STERILIZES SOIL AND PLACES IT IN GROWING CONTAINERS. HE SOWS SEEDS, STARTS CUTTINGS AND TRANSPLANTS SEEDLINGS AND PLANTS. HE WATERS, WEEDS, THINS, PRUNES AND SPRAYS GROWING PLANTS. HE MAINTAINS THE GREENHOUSE STRUCTURE AND EQUIPMENT.

#### WORKING CONDITIONS

MOST OF THE WORK OF A GREENHOUSE WORKER IS PERFORMED INDOORS AND JOBS DONE OUTDOORS USUALLY ARE ACCOMPLISHED DURING FAVORABLE WEATHER. HIS WORK REQUIRES CONSIDERABLE WALKING, STOOPING AND BENDING OVER PLANT OR SEEDBEDS AND HIS HANDS AND CLOTHES ARE USUALLY STAINED FROM SOIL AND PLANT SAP OR JUICES.

HIS WORK IS LARGELY MANUAL LABOR BUT IS NOT UNUSUALLY HARD. WORKING HOURS ARE MOSTLY REGULAR AND EMPLOYMENT IS STEADY THROUGHOUT THE YEAR. SEASONAL DEMANDS SOMETIMES NECESSITATE WORKING EXTRA HOURS.

#### PERSONAL AND EDUCATIONAL EQALIFICATIONS

FOR AN EMPLOYEE TO REALLY ENJOY GREENHOUSE WORK, HE MUST BE INTERESTED IN SEEING PLANTS GROW. GOOD HEALTH IS IMPORTANT BUT CERTAIN TYPES OF PHYSICAL DISABILITIES WILL NOT PREVENT A PERSON WHO IS INTERESTED FROM ENTERING THE OCCUPATION.

A HIGH SCHOOL EDUCATION WITH A COURSE IN VOCATIONAL HORTICULTURE IS DESIRABLE FOR ONE INTERESTED IN THIS OCCUPATION.

#### JOB TITLE - NURSERY WORKER

#### JOB DESCRIPTION

A NURSERY WORKER GROWS SEEDLINGS AND PLANTS FOR LANDSCAPING, FRUIT FARMING AND FOREST REPLANTING. HE MAY WORK IN ONE OF SEVERAL KINDS OF NURSERIES. SOME NURSERIES SPECIALIZE IN PRODUCING FRUIT TREES AND SMALL FRUIT TRANSPLANTS, SOME IN ORNAMENTAL TREES AND SHRUBS, AND SOME IN FOREST REPLANTING MATERIALS. SOME NURSERYMEN OPERATE GREENHOUSES AND PRODUCE THEIR OWN SEEDLINGS AND PLANTS FROM CUTTINGS. SOME PRODUCE PLANTING STOCK OF TWO OR MORE MAJOR LINES OF PLANTS, TREES OR SHRUBS.

A NURSERY WORKER PREPARES SEEDBEDS, PLANTS SEEDLINGS, WEEDS AND CULTIVATES, WATERS, PRUNES AND PERFORMS OTHER CULTURAL PRACTICES, SUCH AS SPRAYING AND GRAFTING. HE DIGS, GRADES AND PACKS PLANTS FOR SHIPMENT. HE MAY CUT, LIFT AND LAY SOD. HE TRANSPLANTS SHRUBS AND TREES, AND IN A TREE NURSERY, GATHERS AND PRUNES FOREST TREE SEEDLINGS. HE HELPS WITH THE MAINTENANCE AND REPAIR OF BUILDINGS AND EQUIPMENT.

#### WORKING CONDITIONS

A GREAT DEAL OF THE NURSERY WORKER'S TIME IS SPENT OUTDOORS. IF A GREENHOUSE IS A MAJOR PART OF THE EMPLOYER'S BUSINESS, AN

EMPLOYEE WILL SPEND A LOT OF TIME IN THE GREENHOUSE. ACTUAL PLANTING, CULTIVATING AND OTHER CULTURAL PRACTICES MUST BE DONE UNDER FAVORABLE WEATHER CONDITIONS, BUT CONSIDERABLE OUTDOOR WORK AT A NURSERY CAN BE DONE IN RATHER ADVERSE WEATHER.

THE WORK IS LARGELY MANUAL LABOR AND SOME OF IT IS ACCOMPLISHED BY HEAVY LIFTING. WORKING HOURS ARE REGULAR AND EMPLOYMENT MAY BE FOR THE ENTIRE YEAR.

#### PERSONAL AND EDUCATIONAL QUALIFICATIONS

TO BE A NURSERY WORKER, ONE SHOULD ENJOY WORKING WITH PLANTS AND BEING IN THE OUT-OF-DOORS. GOOD HEALTH AND PHYSIQUE ARE IMPORTANT AND PHYSICAL HANDICAPS ARE LIKELY TO HINDER ONE IN THIS WORK. A TRUCK DRIVER'S LICENSE MAY BE REQUIRED. THE ABILITY TO IDENTIFY PLANTS AND A KNOWLEDGE OF HOW PLANTS ARE USED IN THE LANDSCAPE ARE QUITE DESIRABLE. A HIGH SCHOOL EDUCATION WITH A COURSE IN HORTICULTURE IS DESIRABLE.

#### JOB TITLE - GARDEN CENTER WORKER

#### JOB DESCRIPTION

A GARDEN CENTER WORKER PERFORMS MANY JOBS INCLUDING CARING FOR ORNAMENTAL PLANTS, MOVING PLANTS AND SUPPLIES INTO SELLING AREAS, ARRANGING PLANTS AND SUPPLIES FOR DISPLAY PURPOSES, AND SELLING THE VARIOUS PRODUCTS HANDLED BY THE GARDEN CENTER. A GARDEN CENTER MAY BE A PART OF A LARGE RETAIL STORE, A PART OF A NURSERY OR GREENHOUSE OPERATION, OR A RETAIL ESTABLISHMENT SEPARATE FROM ANY OTHER BUSINESS.

THE WORK OF A GARDEN CENTER WORKER INCLUDES CLEANING, STOCKING AND ARRANGING GARDEN SUPPLIES ON SHELVES, COUNTERS AND IN WINDOWS. HE CARES FOR ORNAMENTAL PLANTS BY WATERING, TRIMMING, SPRAYING AND CONTROLLING TEMPERATURES. THE EMPLOYEE UNLOADS AND UNPACKS SUPPLIES AS THEY ARRIVE FROM WHOLESALERS, LOADS ORDERS ON TRUCKS, MAKES DELIVERIES AND LOADS ORDERS INTO CUSTOMER'S CARS. HE GIVES INFORMATION TO CUSTOMERS ON CARE OF PLANTS, CARE OF LAWNS, PLANT VARIETIES AND MERITS OF DIFFERENT GARDEN SUPPLIES AND EQUIPMENT.

#### WORKING CONDITIONS

GARDEN CENTERS ARE BUILT AND ARRANGED TO ATTRACT CUSTOMERS; AS A RESULT, A GARDEN CENTER EMPLOYEE USUALLY WORKS IN A RATHER CLEAN, PLEASANT AND COMFORTABLE ENVIRONMENT. SOME OF THE WORK AREA IS USUALLY HEATED IN COLD WEATHER. OTHER AREAS ARE UNHEATED BUT ARE USUALLY PROTECTED FROM RAIN, SNOW AND WIND. SOME OF THE WORK MAY BE OUTDOORS, PARTICULARLY DURING THE SEASON THAT ORNAMENTAL SHRUBS AND TREES ARE FOR SALE. THE WORK IS FAIRLY REGULAR, BUT HAS SEASONAL PEAKS. SOME GARDEN CENTERS CLOSE OR OPERATE WITH ONLY A SKELETON CREW DURING THE WINTER MONTHS.

## PERSONAL AND EDUCATIONAL QUALIFICATIONS

A GARDEN CENTER EMPLOYEE SHOULD ENJOY MEETING PEOPLE, BE INTERESTED IN GIVING GOOD SERVICE TO CUSTOMERS AND LIKE CARING FOR ORNAMENTAL PLANTS. HE MUST BE ABLE TO ENGAGE IN CONVERSATION EASILY AND IN A FRIENDLY MANNER TO BE A SUCCESSFUL SALESMAN.

A HIGH SCHOOL EDUCATION WITH A COURSE IN VOCATIONAL HORTICULTURE IS DESIRABLE.

### JOB TITLE - GROUNDS KEEPER

#### JOB DESCRIPTION

A GROUNDS KEEPER CARES FOR THE AREA SURROUNDING AN INDUSTRY OR BUSINESS, CHURCH, SCHOOL, AIRPORT, APARTMENT BUILDING, PRIVATE ESTATE, CEMETERY OR SHOPPING CENTER. THE EMPLOYEE PLANTS AND CARES FOR LAWNS AND ORNAMENTAL PLANTS. THE WORK INVOLVES MOWING GRASS, RESEEDING AREAS, CONTROLLING WEEDS AND PLANTING AND SPRAYING ORNAMENTAL PLANTS. HE RAKES AND DISPOSES OR LEAVES AND OTHER REFUSE. YEAR ROUND EMPLOYMENT IS PROVIDED THROUGH MAINTENANCE AND REPAIR OR WALKS, DRIVES AND EQUIPMENT. THE WORK MAY INVOLVE MAKING MINOR REPAIRS TO BUILDINGS AND PROVIDING FOR SNOW REMOVAL IN SOME REGIONS OF THE COUNTRY.

#### WORKING CONDITIONS

THE WORK OF THE GROUNDS KEEPER IS OUTDOORS AND DEALS MOSTLY WITH ORNAMENTAL PLANT MATERIALS. THERE IS A VARIETY IN THE WORK. MOST OF THE WORK IS MANUAL LABOR, BUT IS NOT CONSIDERED AS BEING HARD LABOR. THE ENVIRONMENT IN WHICH THE EMPLOYEE WORKS IS USUALLY QUITE DESIRABLE, ALTHOUGH CERTAIN JOBS MUST BE DONE UNDER A VARIETY OF WEATHER CONDITIONS. EMPLOYMENT IS STEADY AND THE EMPLOYEE WORKS REGULAR HOURS, BUT THERE ARE SOME PEAKS IN THE WORK LOAD.

## PERSONAL AND EDUCATIONAL QUALIFICATIONS

AN EMPLOYEE IN THIS KIND OF WORK SHOULD NOT MIND WORKING ALONE AND SHOULD ENJOY WORKING WITH PLANTS, TOOLS AND SMALL GARDEN EQUIPMENT. INsofar AS MOST JOBS ARE DONE OUTDOORS, GOOD HEALTH IS AN ASSET.

### JOB TITLE - GOLF COURSE EMPLOYEE

#### JOB DESCRIPTION

A GOLF COURSE EMPLOYEE'S WORK INVOLVES THE OVERALL MAINTENANCE OF A GOLF COURSE. HE CARES FOR THE TURF ON BOTH THE GREENS AND FAIRWAY. HE INSTALLS AND USES IRRIGATION AND DRAINAGE EQUIPMENT, CLEANS AND MAINTAINS SAND TRAPS, CHANGES THE LOCATION OF THE CUPS AND AERATES THE SOIL. HE MAY DO SOME PRUNING OF SHRUBS AND TREES, REPLACE THE SOD AS NEEDED, AND REPAIR EQUIPMENT AND BUILDINGS.

## WORKING CONDITIONS

THE WORK IS MOSTLY OUTDOORS AND MOST OF IT IS PERFORMED DURING FAIRLY GOOD WEATHER. THE WORK DAY IS USUALLY EIGHT HOURS. IN THE SOUTHERN PART OF THE UNITED STATES, EMPLOYMENT IS STEADY THROUGHOUT THE YEAR. IN SECTIONS OF THE COUNTRY HAVING COLD WINTERS, EMPLOYMENT IS FROM MARCH OR APRIL THROUGH OCTOBER OR NOVEMBER.

## PERSONAL AND EDUCATIONAL QUALIFICATIONS

BECAUSE A GREAT DEAL OF WALKING IS INVOLVED IN GOLF COURSE MAINTENANCE, A WORKER SHOULD HAVE REASONABLY GOOD HEALTH, BUT CERTAIN PHYSICAL HANDICAPS WILL NOT INTERFERE WITH ONE'S SUCCESS. THE EMPLOYEE SHOULD ENJOY WORKING OUTDOORS, HAVE A PLEASING PERSONALITY AND BE TOLERANT OF OTHERS.

A HIGH SCHOOL EDUCATION WITH A COURSE IN AGRICULTURE-HORTICULTURE IS DESIRABLE.

## JOB TITLE - CITY, STATE OR NATIONAL PARK EMPLOYEE

### JOB DESCRIPTION

A PARK EMPLOYEE PERFORMS THE WORK NECESSARY FOR PROPER MAINTENANCE OF PARK FACILITIES INCLUDING TREES, SHRUBS, FLOWER-AND LAWNS THAT MAKE UP THE PLANTING AREA. THE CITY PARK WORKER WILL BE DEALING MORE WITH FORMAL FLOWER BEDS AND LAWN AREAS, WHILE THE STATE OR NATIONAL PARK WORKER WILL DEAL MORE WITH CARE AND MAINTENANCE OF NATURAL WOODLANDS OR FOREST.

THE WORK OF THE PARK EMPLOYEE INCLUDES MOWING GRASS, TRIMMING THE EDGES OF WALKS AND DRIVEWAYS; PLANTING, PRUNING AND CARING FOR TREES, SHRUBS, HEDGES, LAWNS AND FLOWER BEDS; CONTROLLING INSECTS, DISEASES AND WEEDS, AND CARING FOR THE SOIL. THE WORK INCLUDES SUCH JOBS AS REMOVING TRASH OR SNOW, MAINTENANCE OF SWIMMING POOLS, CARE OF BOATING FACILITIES, GENERAL MAINTENANCE OF BUILDINGS AND EQUIPMENT AND REPAIR OF ROADWAYS AND DRIVES.

### WORKING CONDITIONS

THE WORK OF A PARK EMPLOYEE IS OUTDOORS MOST OF THE TIME. MOST OF IT IS NOT HARD MANUAL LABOR, AND IT IS PERFORMED IN A HEALTHY, PLEASANT ENVIRONMENT. SOMETIMES PARK IMPROVEMENT JOBS HAVE TO BE DONE UNDER UNFAVORABLE WEATHER CONDITIONS. THIS OCCUPATION USUALLY PROVIDES STEADY EMPLOYMENT THROUGHOUT THE YEAR, AND WORKING HOURS ARE REGULAR, IN CERTAIN TYPES OF STATE PARK WORK, PEAK PERIODS MAY OCCUR.

## PERSONAL AND EDUCATIONAL QUALIFICATIONS

ONE INTERESTED IN BECOMING A PARK EMPLOYEE SHOULD APPRECIATE NATURE, ENJOY WORKING OUTDOORS AND LIKE WORKING WITH PLANTS. IT IS DESIRABLE TO HAVE AN INTEREST IN LANDSCAPE DEVELOPMENT, AND A PRIDE IN THE APPEARANCE OF ONE'S ACCOMPLISHMENTS. GOOD HEALTH IS NECESSARY BECAUSE MANUAL LABOR IS A REQUIREMENT OF THIS WORK.

A HIGH SCHOOL EDUCATION WITH A COURSE IN VOCATIONAL HORTICULTURE IS MOST DESIRABLE FOR ONE INTERESTED.

## VALIDATION OF ORNAMENTAL HORTICULTURE UNITS

THE ORNAMENTAL HORTICULTURE UNITS HAVE BEEN DEVELOPED THROUGH THE USE OF MANY VARYING CURRICULUM GUIDES AND INSTRUCTIONAL MATERIALS ACCUMULATED FROM VARIOUS SOURCES THROUGHOUT THE UNITED STATES. THESE CURRICULUM GUIDES AND INSTRUCTIONAL MATERIALS RANGED FROM TOPIC OUTLINES TO COMPREHENSIVE REFERENCE MATERIALS. THE UNITS CONTAINED IN THIS GUIDE WILL HOPEFULLY PROVIDE A COMPREHENSIVE BASE FOR PROGRAM PLANNING AND DEVELOPMENT BY STATE CURRICULUM PLANNERS, STATE SUPERVISORS AND TEACHERS IN DEVELOPING LOCAL PROGRAMS. MUCH OF THE MATERIAL IS BASED ON CURRICULUM MATERIALS DEVELOPED AT THE PENNSYLVANIA STATE UNIVERSITY PURSUANT TO A CONTRACT FROM THE UNITED STATES OFFICE OF EDUCATION DURING THE PERIOD 1968 - 1971. THESE PUBLICATIONS INCLUDE:

RETAIL FLOWER SHOP OPERATION AND MANAGEMENT -- A TEACHER'S MANUAL

LANDSCAPE MAINTENANCE AND ESTABLISHMENT -- A TEACHER'S MANUAL

LANDSCAPE DESIGN -- A TEACHER'S MANUAL

TURFGRASS MAINTENANCE AND ESTABLISHMENT -- A TEACHER'S MANUAL

GREENHOUSE CROP PRODUCTION -- A TEACHER'S MANUAL

NURSERY PRODUCTION -- A TEACHER'S MANUAL

THIS SERIES OF TEACHER AND STUDENT MANUALS COVERS ALL OCCUPATIONAL AREAS OF ORNAMENTAL HORTICULTURE CONTAINED IN THIS CURRICULUM GUIDE. THEY WERE PREPARED BY STAFF MEMBERS OF THE AGRICULTURAL EDUCATION DEPARTMENT AND WERE REVIEWED FOR TECHNICAL ACCURACY BY STAFF MEMBERS OF THE DEPARTMENT OF HORTICULTURE AND REPRESENTATIVES FROM VARIOUS HORTICULTURAL BUSINESSES. TEACHER INSTITUTES WERE ALSO HELD FOR THE PURPOSE OF REVIEWING AND REVISING THE MATERIALS BEFORE FIELD TESTING BY THE TEACHERS.



OTHER SOURCES INCLUDED STUDENT MANUALS DEVELOPED AND VALIDATED BY THE OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, WHICH INCLUDE THE NURSERY WORKER I & II, THE GREENHOUSE WORKER, TURFGRASS MANAGEMENT, THE GARDEN CENTER WORKER, AS WELL AS OTHER MATERIALS DEALING WITH MORE SPECIFIC SUBJECT MATTER. PROJECT HORTICULTURE, DIRECTED BY THE UNIVERSITY OF FLORIDA, WAS A PRIMARY BASIS FOR DETERMINING COMPETENCIES AND CONTENT NEEDED FOR THE NURSERY SECTION OF THIS GUIDE. THE CURRICULUM GUIDE, SPECIALIZED CURRICULUM IN HORTICULTURE, DEVELOPED AT THE UNIVERSITY OF ARIZONA, TUCSON, WAS ALSO USED IN UNIT DEVELOPMENT. OTHER GUIDES AND INSTRUCTIONAL MATERIALS OF GREAT VALUE WERE USED FROM NEW YORK, MINNESOTA, MICHIGAN, NORTH CAROLINA, OHIO, ILLINOIS, WISCONSIN, TEXAS, COLORADO, AND OREGON.

THE TERMINAL OBJECTIVES CITED AT THE BEGINNING OF THE UNITS ARE BASED UPON OCCUPATIONAL ANALYSES CONDUCTED BY THE PROJECT STAFF AND/OR OTHER OCCUPATIONAL ANALYSES CONDUCTED IN THE VARIOUS OCCUPATIONAL CLUSTER AREAS OF ORNAMENTAL HORTICULTURE BY VARIOUS INDIVIDUALS THROUGHOUT THE UNITED STATES. PROJECT HORTICULTURE CITED EARLIER IS AN EXAMPLE OF ADDITIONAL SOURCES OF INFORMATION FOR THESE ANALYSES. RESEARCH BY OEN IN MICHIGAN, SHRY IN WEST VIRGINIA, LONG IN WASHINGTON, DIRKSEN IN UTAH, BASS IN VIRGINIA AND BERKEY AND DRAKE IN NEW YORK WERE OTHER VALUABLE SOURCES OF INFORMATION FOR DEVELOPING THE OBJECTIVES.

THE UNITS INCLUDED IN THIS GUIDE HAVE BEEN REVIEWED BY VARIOUS ORNAMENTAL HORTICULTURE INSTRUCTORS IN OHIO. THESE TEACHERS HAVE ALL HAD EXTENSIVE OCCUPATIONAL EXPERIENCE IN THE HORTICULTURAL INDUSTRY BEFORE BEGINNING THEIR TEACHING CAREERS IN VARIOUS ORNAMENTAL HORTICULTURE PROGRAMS. TEACHERS OF ORNAMENTAL HORTICULTURE PROGRAMS IN MARYLAND, PENNSYLVANIA AND WEST VIRGINIA HAVE ALSO REVIEWED AND CRITIQUED THIS CURRICULUM GUIDE.

ANOTHER PHASE OF THE VALIDATION PROCESS INCLUDED THE REVIEW OF THE GUIDE BY STATE AND NATIONAL CURRICULUM SPECIALISTS. THESE INDIVIDUALS ARE INVOLVED WITH DEVELOPING CURRICULUM MATERIALS FULL TIME AND PROVIDED VALUABLE INPUT FOR THE REVISION AND IMPROVEMENT OF THIS GUIDE.

IT MUST ALSO BE NOTED THAT ALTHOUGH THIS SECTION HAS CITED SOURCES OF REFERENCES USED IN DEVELOPING THE GUIDE, THIS IS BY NO MEANS AN EXHAUSTIVE LIST OF THOSE MATERIALS ACQUIRED AND USED AS INFORMATION SOURCES. THE STATE OF THE ART IN CURRICULUM MATERIALS IN ORNAMENTAL HORTICULTURE AS FOUND BY THIS PROJECT IS VERY PROMISING. MANY STATE DEPARTMENTS AND CURRICULUM LABS HAVE DEVELOPED EXCELLENT INSTRUCTIONAL AIDS, INCLUDING STUDENT MANUALS, FILM STRIP AND SLIDE SERIES, TRANSPARENCY SETS AND CURRICULUM GUIDES WHICH CAN BE USED AS SUPPLEMENTARY REFERENCE MATERIALS FOR THE UNITS IN THIS GUIDE.

THIS CURRICULUM GUIDE IN ORNAMENTAL HORTICULTURE PROVIDES A PLAN FOR DEVELOPING PROGRAMS BASED ON MANY OF THESE VARYING INSTRUCTIONAL MATERIALS AND CITES REFERENCES FROM SEVERAL OF THESE SOURCES OF CURRICULUM MATERIALS. OTHER VALUABLE AIDS ARE AVAILABLE FROM THESE SOURCES WHICH WILL COMPLEMENT THE INSTRUCTIONAL PROGRAM OUTLINED IN THIS CURRICULUM GUIDE.



## I

ORNAMENTAL HORTICULTURE  
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UNITS GENERAL TO THE ORNAMENTAL HORTICULTURE AREAS

OCCUPATIONAL OPPORTUNITIES IN ORNAMENTAL HORTICULTURE

DEVELOPING LEADERSHIP THROUGH FFA

ORNAMENTAL HORTICULTURE SALESMANSHIP AND SELLING

EMPLOYABILITY SKILLS AND HUMAN RELATIONS

HAND AND POWER TOOLS AND HARDWARE USED IN ORNAMENTAL HORTICULTURE

OPERATION AND CARE OF SMALL GASOLINE ENGINES

MAINTENANCE OF SMALL GASOLINE ENGINES

OPERATION AND MAINTENANCE OF GASOLINE AND DIESEL POWER UNITS

## OCCUPATIONAL OPPORTUNITIES IN ORNAMENTAL HORTICULTURE

**UNIT CONCEPT:** THE FIELD OF ORNAMENTAL HORTICULTURE INCLUDES A BROAD SPECTRUM OF CAREER OPPORTUNITIES THE STUDENT MAY WISH TO EXPLORE. BY STUDYING THE VARIOUS OCCUPATIONS THE STUDENT IS ABLE TO CONSIDER VARIOUS FACTORS SUCH AS WORKING CONDITIONS, SALARY AND REQUIREMENTS FOR ENTRY THAT WILL INFLUENCE HIS CAREER CHOICE.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN SEEKING INFORMATION ABOUT JOB OPPORTUNITIES, SURVEY OR OBTAIN LITERATURE INFORMATION WHICH WILL ASSIST THE STUDENT IN DETERMINING THE NUMBER AND KIND OF JOB OPPORTUNITIES THAT ARE AVAILABLE IN ORNAMENTAL HORTICULTURE.
2. WHEN GIVEN A SPECIFIC CAREER WHICH THE STUDENT IS INTERESTED IN, DETERMINE THE COMPETENCIES AND REQUIREMENTS NEEDED BY PERSONS TO ENTER AND ADVANCE IN THAT CAREER.
3. UPON DETERMINING THE REQUIREMENTS AND COMPETENCIES NEEDED TO ENTER A JOB, DEVELOP A PERSONAL PLAN WHICH WILL AID THE STUDENT IN ACQUIRING THE COMPETENCIES AND MEETING THE REQUIREMENTS NEEDED FOR ENTRY IN THAT JOB.
4. UPON IDENTIFYING A JOB IN WHICH THE STUDENT IS INTERESTED, FOLLOW THE PROPER PROCEDURES NECESSARY TO BECOME PLACED ON THE JOB.
5. UPON SECURING PLACEMENT ON A JOB, WORK WITH OTHER EMPLOYEES, THE EMPLOYER AND CUSTOMERS IN A MANNER THAT WILL ENABLE THE STUDENT TO SUCCEED ON THE JOB.

### B. INSTRUCTIONAL AREAS

1. ASSESSING THE JOB OPPORTUNITIES AVAILABLE IN ORNAMENTAL HORTICULTURE
  - A. LOCATING INFORMATION REGARDING THE SCOPE OF ORNAMENTAL HORTICULTURAL OCCUPATIONS AND THE OPPORTUNITIES FOR EMPLOYMENT

- B. SURVEYING THE LOCAL REGION FOR ENTRY LEVEL JOBS REGARDING THE NUMBER OF OPENINGS PER YEAR AND FUTURE EMPLOYMENT NEEDS
- 2. MAKING A DETAILED STUDY OF SELECTED ORNAMENTAL HORTICULTURAL OCCUPATIONS
  - A. DETERMINING WHAT PERSONAL INTERESTS ARE AND HOW THEY RELATE TO A SPECIFIC JOB OR CLUSTER OF OCCUPATIONS
  - B. ASSESSING THE COMPETENCIES THAT ARE NEEDED FOR ENTRY
  - C. DETERMINING THE EDUCATIONAL REQUIREMENTS NECESSARY FOR EMPLOYMENT
  - D. ASSESSING THE PERSONAL TRAITS REQUIRED BY THE OCCUPATION
  - E. DETERMINING THE WORKER BENEFITS IN A GIVEN OCCUPATION
  - F. CONSIDERING FEDERAL REGULATIONS WHICH APPLY TO VARIOUS OCCUPATIONS
- 3. DEVELOPING A PERSONAL PLAN FOR GAINING EXPERIENCES NECESSARY FOR GAINFUL EMPLOYMENT IN A GIVEN OCCUPATIONAL AREA
  - A. PLANNING ACTIVITIES THAT WILL ENABLE THE STUDENT TO BE EXPOSED TO EXPERIENCES WHICH WILL AID IN HIS EMPLOYMENT
  - B. WORKING WITH COOPERATORS IN DEVELOPING THE OCCUPATIONAL EXPERIENCE PROGRAM
  - C. RECORDING THE ACTIVITIES IN THE OCCUPATIONAL EXPERIENCE PROGRAM
  - D. SUPERVISING AND EVALUATING THE STUDENT'S OCCUPATIONAL EXPERIENCE PROGRAM
- 4. SECURING A JOB BY FOLLOWING THE PROPER PROCEDURES INVOLVED IN JOB PLACEMENT
  - A. LOCATING POTENTIAL JOBS THROUGH VARIOUS SOURCES
  - B. ASSESSING THE JOB DESCRIPTION AND THE STUDENT'S INTERESTS

### C. APPLYING FOR A JOB

- (1) WRITING A LETTER OF APPLICATION
- (2) PREPARING A RESUME
- (3) SECURING REFERENCES

### D. CONDUCTING THE PERSONAL INTERVIEW

## 5. CONSIDERING FACTORS IMPORTANT TO JOB SUCCESS AND ADVANCEMENT

- A. ESTABLISHING RAPPORT WITH FELLOW EMPLOYEES, THE PUBLIC AND THE EMPLOYER
- B. PERSONAL GROOMING AND ITS IMPACT UPON THE PUBLIC, THE EMPLOYER AND FELLOW EMPLOYEES
- C. FOLLOWING DIRECTIONS AND WORKING INDEPENDENTLY IN AN OCCUPATION
- D. DEVELOPING DESIRABLE WORK HABITS
- E. CONTINUING SELF IMPROVEMENT ON THE JOB

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. CONDUCT A PERSONAL SURVEY BY PERSONAL CONTACT OR QUESTIONNAIRE OF ORNAMENTAL HORTICULTURE BUSINESSES TO DETERMINE THE NUMBER OF PERSONNEL EMPLOYEES IN VARIOUS JOBS IN ORNAMENTAL HORTICULTURE AND THE NUMBER OF OPENINGS EACH YEAR.
- 2. INTERVIEW SEVERAL PERSONS IN SPECIFIC OCCUPATIONS AND DETERMINE THE COMPETENCIES AND REQUIREMENTS NEEDED TO ENTER THE OCCUPATION.
- 3. VISIT THE MANAGER OF AREA ORNAMENTAL HORTICULTURE BUSINESSES AND DISCUSS WITH HIM THE FACTORS HE CONSIDERS IN HIRING AN EMPLOYEE.
- 4.
  - A. WRITE A LETTER OF APPLICATION AND FILL OUT AN APPLICATION FORM AND HAVE THE CLASS MEMBERS CRITIQUE IT.
  - B. USING SIMULATION TECHNIQUES, HAVE THE STUDENTS ROLE PLAY JOB INTERVIEWS. RECORD THE INTERVIEWS ON A TAPE RECORDER AND HAVE EACH STUDENT CRITIQUE HIS OWN PRESENTATION. TO GUIDE THE STUDENTS IN THE CRITIQUE, HAVE THE CLASS DEVELOP A LIST OF CRITERIA FOR JOB INTERVIEWS AND CHECK THEMSELVES AGAINST THESE CRITERIA.

5. USING A PANEL COMPOSED OF EMPLOYERS AND EMPLOYEES, HAVE THE CLASS DISCUSS WITH THEM THE DEVELOPMENT AND MAINTENANCE OF WORKING RELATIONSHIPS BETWEEN EMPLOYEES AND EMPLOYER.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING A LIST OF ORNAMENTAL HORTICULTURE JOB TITLES, HAVE STUDENTS MATCH THESE TO THE MOST APPROPRIATE HORTICULTURAL AREA I.E. NURSERY, TURFGRASS, ARBORICULTURE, LANDSCAPING, AND FLORICULTURE. THESE JOB TITLES COULD ALSO BE MATCHED TO LEVEL OF POSITION SUCH AS SKILLED, SEMI-SKILLED, TECHNICAL AND PROFESSIONAL. THESE TASKS SHOULD BE ACCOMPLISHED WITH 90% ACCURACY TO ALLOW FOR VARIATION IN JOB TITLES NAMES.
2. HAVE STUDENT DEVELOP A LIST OF POINTS TO REMEMBER OR A CHECK LIST FOR WRITING A LETTER OF APPLICATION FOR A PARTICULAR JOB. THIS LIST SHOULD INCLUDE SUCH ITEMS AS NEATNESS, PROPER INTRODUCTION OF APPLICANT, WHERE APPLICANT CAN BE CONTACTED, REQUEST FOR NECESSARY APPLICATION FORMS, COMPLETENESS, AND PERSONAL REFERENCES.
3. THE STUDENT WILL COMPLETE A SURVEY OF A GIVEN OCCUPATION OR CLUSTER OF OCCUPATIONS TO THE SATISFACTION OF THE TEACHER, WHICH ASSESSES THE COMPETENCIES NEEDED FOR EMPLOYMENT, THE EDUCATIONAL REQUIREMENTS FOR GAINING EMPLOYMENT AND THE PERSONAL CHARACTERISTICS NEEDED FOR SUCCESSFUL EMPLOYMENT.
4. WHEN GIVEN AN "EXAMPLE" JOB, THE STUDENT WILL DESCRIBE, LIST AND EXPLAIN THE STEPS OR PROCEDURE(S) HE WOULD FOLLOW IN ORDER TO BE PLACED ON THE JOB. THIS DESCRIPTION SHOULD INCLUDE: (1) WRITING LETTER OF APPLICATION, (2) PREPARING FOR THE INTERVIEW, AND (3) PRESENTING HIMSELF TO THE EMPLOYER AS A "WORTHY" CANDIDATE.
5. USING ROLE PLAYING WITH A RECORDER OR VIDEO RECORDER, HAVE STUDENTS SIMULATE THE HUMAN RELATIONS ASPECT OF THE WORKING ENVIRONMENT AND "ROLE PLAY" VARIOUS SITUATIONS. EVALUATION SHOULD BE BASED UPON STUDENT'S ABILITY TO DEAL WITH FELLOW WORKERS AND CUSTOMERS ACCORDING TO INDUSTRY EXPECTATIONS.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. SAMPLES OF JOB APPLICATION FORMS, LETTERS OF APPLICATION, OCCUPATIONAL SURVEY FORMS, PERSONAL CHARACTERISTICS CHECK LISTS, AND COPIES OF STATE AND FEDERAL LABOR REGULATIONS.

2. APPROPRIATE TABLES, DESKS, CHAIRS AND TAPE RECORDER OR VIDEO-TAPE MACHINES NECESSARY FOR CONDUCTING SIMULATED JOB INTERVIEWS.
3. WRITTEN NOTICES FROM NEWSPAPERS, JOURNALS AND OTHER PUBLICATIONS LISTING VARIOUS JOB OPENINGS.

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. BINKLEY, HAROLD AND HAMMONDS, CARLIE. EXPERIENCE PROGRAMS FOR LEARNING VOCATIONS IN AGRICULTURE. DANVILLE, ILLINOIS: THE INTERSTATE PRINTERS AND PUBLISHERS, INC. PP. 45-69, 331-336, 401-421.

THIS PUBLICATION PRESENTS AN OVERVIEW OF THE EXPERIENCE PROGRAM AND THE OPPORTUNITIES IN ORNAMENTAL HORTICULTURE THAT STUDENTS WILL FIND RELATIVELY EASY TO UNDERSTAND.

2. OPPORTUNITIES IN AGRICULTURAL OCCUPATIONS AND THE EMPLOYEE WITHIN THE BUSINESS ORGANIZATION. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 3-43.

A STUDENT MANUAL, THIS REFERENCE MAY BE HELPFUL WHEN COVERING SUCH TOPICS AS APPLYING FOR A JOB, ASSESSING ONE'S PERSONAL CHARACTERISTICS, AND LOCATING JOB OPPORTUNITIES.

3. ORNAMENTAL HORTICULTURE: A GUIDE FOR PLANNING OCCUPATIONAL PROGRAMS. ALBANY, NEW YORK: THE STATE EDUCATION DEPARTMENT, THE UNIVERSITY OF THE STATE OF NEW YORK. 1968

A CURRICULUM GUIDE, THE TEACHER WILL FIND IN OUTLINE FORM THE VARIOUS AREAS OF INSTRUCTION THAT SHOULD BE COVERED IN EXPLORING OCCUPATIONS IN ORNAMENTAL HORTICULTURE.

4. RESOURCE UNIT ON CAREER OPPORTUNITIES FOR CORE CURRICULUM. TUCSON, ARIZONA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE UNIVERSITY OF ARIZONA.

DEVELOPED IN AN OUTLINE FORMAT, THIS REFERENCE WILL BE HELPFUL TO THE INSTRUCTOR IN DEVELOPING QUESTIONS AND PROBLEMS FOR DISCUSSION. INCLUDED IS A LIST OF FILM STRIPS AND STUDENT ACTIVITIES FOR EXPLORING AGRICULTURAL OCCUPATIONS.



## DEVELOPING LEADERSHIP THROUGH FFA

**UNIT CONCEPT:** ACTIVE PARTICIPATION IN THE FFA WILL PROVIDE THE STUDENT OPPORTUNITIES FOR DEVELOPING PRACTICAL TRAINING IN AGRICULTURE, LEADERSHIP, CO-OPERATION AND CITIZENSHIP.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. USING THE BASIC PRINCIPLES OF LEADERSHIP, IDENTIFY THE ROLE OF THE FFA ORGANIZATION IN ORNAMENTAL HORTICULTURE EDUCATION.
2. USING THE OFFICIAL FFA MANUAL, IDENTIFY THE HISTORY, AIMS AND PURPOSES AND ORGANIZATION OF THE FFA ON THE LOCAL, STATE AND NATIONAL LEVEL.
3. BY ACTIVELY PARTICIPATING IN THE ORGANIZATION'S BUSINESS MEETING, DEMONSTRATE THE PRINCIPLES OF PARLIAMENTARY PROCEDURE AS PRESENTED IN ROBERT'S RULES OF ORDER OR OTHER ACCEPTABLE REFERENCES.
4. THROUGH ACTIVE PARTICIPATION IN THE ORGANIZATION, SERVE EFFECTIVELY AS A COMMITTEE MEMBER AND/OR CHAIRMAN IN PLANNING AND CARRYING OUT THE CHAPTER PROGRAM OF ACTIVITIES.
5. IF ELECTED, SERVE EFFECTIVELY AS AN OFFICER IN THE ORGANIZATION BY FULFILLING THE DUTIES OF THE OFFICE TO WHICH ELECTED.
6. THROUGH CHAPTER AND CLASSROOM ACTIVITIES, DEVELOP EFFECTIVE PUBLIC SPEAKING SKILLS SO AS TO BE ABLE TO MAKE INTRODUCTIONS, PARTICIPATE IN CONVERSATIONS AND PREPARE AND DELIVER SPEECHES AND TALKS.
7. THROUGH ACTIVE PARTICIPATION IN THE FFA, DEVELOP A STRONG SELF CONCEPT AND A POSITIVE ATTITUDE TOWARD WORKING IN SOCIETY AS EVIDENCED BY HIS PUBLIC AND PRIVATE ACTIVITIES.

## B. INSTRUCTIONAL AREAS

### 1. DEVELOPING LEADERSHIP

A. PURPOSES FOR ATTAINING LEADERSHIP SKILLS

B. TYPES OF LEADERSHIP

- (1) FORMAL LEADERSHIP
- (2) INFORMAL LEADERSHIP

C. QUALITIES OF LEADERSHIP

D. STYLES OF LEADERSHIP

E. FUNCTIONS OF DEMOCRATIC LEADERSHIP

F. OPPORTUNITIES FOR DEVELOPING LEADERSHIP ABILITIES

- (1) HOME
- (2) SCHOOL
- (3) COMMUNITY
- (4) FFA

### 2. DETERMINING THE PLACE OF FFA IN ORNAMENTAL HORTICULTURE EDUCATION

A. THE VALUES OF FFA MEMBERSHIP

B. THE CONTRIBUTION OF THE FFA TO THE SCHOOL AND COMMUNITY

### 3. DETERMINING THE BACKGROUND OF THE FFA

A. IMPORTANT HISTORICAL FACTS

B. AIMS AND PURPOSES

C. COLORS, EMBLEM, MOTTO AND CREED

### 4. GOVERNING AND FINANCING THE FFA

A. LOCAL

B. STATE

C. NATIONAL

### 5. ATTAINING FFA MEMBERSHIP AND DEGREES

A. TYPES OF MEMBERSHIP

B. LOCAL, STATE AND NATIONAL DEGREES

6. PLANNING AND CONDUCTING A CHAPTER MEETING
  - A. IDENTIFYING OFFICER RESPONSIBILITIES
  - B. IDENTIFYING MEMBER RESPONSIBILITIES
  - C. CONDUCTING THE BUSINESS MEETING
7. PLANNING AND CONDUCTING THE CHAPTER PROGRAM OF ACTIVITIES
  - A. IDENTIFYING AREAS TO BE INCLUDED
  - B. DEVELOPING A PROGRAM OF ACTIVITIES
  - C. CARRYING OUT THE PROGRAM OF ACTIVITIES
    - (1) IDENTIFYING CHAIRMAN RESPONSIBILITIES
    - (2) IDENTIFYING COMMITTEE MEMBER RESPONSIBILITIES
8. PERFORMING FFA OFFICER DUTIES AND RESPONSIBILITIES
  - A. IDENTIFYING QUALIFICATIONS FOR LOCAL, STATE AND NATIONAL OFFICES
  - B. IDENTIFYING SPECIFIC DUTIES OF EACH OFFICER
  - C. DETERMINING GENERAL RESPONSIBILITIES OF AN OFFICER
    - (1) CONDUCTING CHAPTER PROGRAMS
    - (2) PARTICIPATING IN OFFICER MEETINGS
    - (3) PARTICIPATING IN LEADERSHIP ACTIVITIES
    - (4) CONDUCTING CHAPTER MEETINGS
9. DEVELOPING PROFICIENCY IN PARLIAMENTARY PROCEDURE
  - A. PRESIDING OVER MEETINGS
  - B. PRESENTING MOTIONS CORRECTLY
10. DEVELOPING PUBLIC SPEAKING SKILLS
  - A. DEVELOPING CONVERSATION SKILLS
  - B. MAKING INTRODUCTIONS
  - C. PREPARING A SPEECH OR TALK
  - D. DELIVERING A SPEECH OR TALK
11. DETERMINING RESPONSIBILITIES OF FFA MEMBERS
  - A. DEVELOPING PERSONAL ATTRIBUTES

- (1) PERSONAL APPEARANCE
- (2) PROPER MANNERS
- (3) BEHAVIOR IN PUBLIC

B. USING THE FFA CODE OF ETHICS

C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. ANALYZE THE QUALITIES OF RECOGNIZED GOOD LEADERS.
2. ATTEND STATE AND/OR NATIONAL FFA CONVENTIONS TO OBSERVE THE OPERATION OF THE ORGANIZATION.
3. A. PARTICIPATE IN CLASSROOM STUDY AND PRACTICE OF PARLIAMENTARY PROCEDURE TO DEVELOP PARLIAMENTARY PROCEDURE SKILLS.  
  
B. PLAN AND POST AGENDA IN ADVANCE OF REGULAR CHAPTER MEETINGS TO PROMOTE ATTENDANCE AND PARTICIPATION BY ALL MEMBERS.  
  
C. ATTEND AND PARTICIPATE IN FFA MEETINGS TO DEVELOP LEADERSHIP ABILITIES.  
  
D. PREPARE FOR AND PARTICIPATE IN PARLIAMENTARY PROCEDURE DEMONSTRATIONS AND CONTESTS.
4. A. ACCEPT AN FFA COMMITTEE ASSIGNMENT SUITED TO INTEREST AND ABILITY TO DEVELOP SKILLS IN COMMITTEE WORK.  
  
B. SERVE AS A COMMITTEE CHAIRMAN TO DEVELOP LEADERSHIP SKILLS.  
  
C. PREPARE WRITTEN AND ORAL COMMITTEE REPORTS AND PRESENT THEM AT FFA MEETINGS TO DEVELOP PERSONAL SKILLS AND TO FACILITATE OPERATION OF THE ORGANIZATION.  
  
D. PARTICIPATE IN SPECIAL TRAINING PROGRAMS FOR COMMITTEE CHAIRMEN TO OBTAIN SKILLS IN COMMITTEE WORK.
5. A. ARRANGE FOR ELECTION OF FFA OFFICERS AND PARTICIPATE AS AN OFFICER, IF ELECTED.  
  
B. PLAN, CONDUCT AND/OR PARTICIPATE IN LEADERSHIP WORKSHOPS OR OFFICER-TRAINING PROGRAMS.  
  
C. ESTABLISH PERFORMANCE STANDARDS FOR LOCAL FFA OFFICERS.
6. A. PARTICIPATE IN CLASSROOM DISCUSSIONS, DEMONSTRATIONS, ORAL AND WRITTEN REPORTS, AND LOCAL PUBLIC SPEAKING COMPETITION.

B. ENTER PUBLIC SPEAKING CONTESTS ABOVE THE LOCAL LEVEL.

C. PARTICIPATE IN LEADERSHIP ACTIVITIES ABOVE THE LOCAL LEVEL.

D. PRACTICE MAKING FORMAL INTRODUCTIONS THROUGH ROLE PLAYING.

E. HAVE EACH STUDENT PREPARE A SHORT TALK OR SPEECH TO PRESENT IN CLASS, USING A TAPE RECORDER OR VIDEO-TAPE FOR THE STUDENT TO HEAR AND/OR OBSERVE HIS PERFORMANCE.

7. CONDUCT A SELF-EVALUATION OF LEADERSHIP QUALITIES, PERSONALITY CHARACTERISTICS, AND OTHER PERSONAL ATTRIBUTES, IDENTIFYING STRONG POINTS TO BUILD UPON AND WEAK POINTS NEEDING IMPROVEMENT.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. HAVE EACH STUDENT LIST THE QUALITIES OF A DEMOCRATIC LEADER SO THAT ATTAINMENT OF THE QUALITIES WOULD RESULT IN A PERSON DISPLAYING DEMOCRATIC LEADERSHIP.
2. DEVELOP A MATCHING TEST IN WHICH EACH STUDENT WOULD MATCH THE PARTS OF THE FFA EMBLEM WITH WHAT IT SYMBOLIZES WITH COMPLETE ACCURACY.
4. DIVIDE THE CLASS INTO GROUPS TO PRESENT A BUSINESS MEETING. THE TEACHER SHOULD EVALUATE EACH GROUP AND MEMBER AS TO THEIR POISE AND KNOWLEDGE OF PARLIAMENTARY PROCEDURE.
4. HAVE EACH MEMBER ASSIGNED RESPONSIBILITIES FOR ASSISTING IN PLANNING AND CONDUCTING THE CHAPTER PROGRAM OR ACTIVITIES. EVALUATE EACH MEMBER IN REFERENCE TO COMPLETION OF HIS ASSIGNED TASKS AND THE IMPROVEMENT THAT HE EXHIBITS OVER EACH GRADING PERIOD.
5. HAVE THE SECRETARY, TREASURER, AND REPORTER REGULARLY SUBMIT THEIR BOOKS TO THE AUDITING COMMITTEE AND TEACHER FOR EVALUATION AS TO COMPLETENESS, NEATNESS AND ACCURACY.
6. CONDUCT A PUBLIC SPEAKING CONTEST IN EACH CLASS FOR THE TEACHER TO EVALUATE EACH STUDENT FOR HIS PRESENTATION IN RELATION TO HIS SPEAKING ABILITIES.
7. HAVE EACH STUDENT COMPLETE A PERSONAL EVALUATION FORM AS TO HIS ATTITUDES TOWARD HIMSELF AND SOCIETY. THE TEACHER SHOULD PRIVATELY DISCUSS THE PERSONAL EVALUATION

WITH EACH STUDENT TO RECOGNIZE STRONG POINTS AND WEAK POINTS NEEDING IMPROVEMENT.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. OFFICIAL FFA PARAPHERNALIA
2. OFFICIAL FFA SECRETARY'S AND TREASURER'S BOOKS
3. OFFICIAL FFA SCRAPBOOK
4. TAPE RECORDER OR VIDEO-TAPE

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. BENDER, RALPH E. THE FFA AND YOU. DANVILLE, ILLINOIS: THE INTERSTATE PRINTERS AND PUBLISHERS, INC. 1962, 494 PAGES.

THIS TEXT COVERS ALL AREAS OF FFA PROGRAM ACTIVITIES AS WELL AS OFFICER AND MEMBER DUTIES AND RESPONSIBILITIES. IT IS AN EXCELLENT REFERENCE FOR BEGINNING MEMBERS AND OFFICERS.

2. MEMBERSHIP - THE PATHWAY TO LEADERSHIP. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1972, 23 PAGES.

AN AID FOR TEACHER UNIT PLANNING AND FOR THE STUDENT, THIS BOOKLET EMPHASIZES FUNDAMENTAL LEADERSHIP COMPETENCIES TO BE DEVELOPED BY ALL MEMBERS.

3. OFFICIAL MANUAL, FUTURE FARMERS OF AMERICA. ALEXANDRIA, VIRGINIA: FUTURE FARMERS SUPPLY SERVICE. 1972, 128 PAGES.

THIS MANUAL WILL ASSIST BOTH MEMBERS AND ADVISORS IN GAINING AN UNDERSTANDING OF THE HISTORY, ORGANIZATION, AND OPERATING OF THE FFA.

4. STEWART, W.F. HELPS IN MASTERING PARLIAMENTARY PROCEDURE. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1969, 17 PAGES.

A SIMPLE AND EASILY UNDERSTOOD BOOKLET CONTAINING THE BASIC RULES OR PARLIAMENTARY PROCEDURE. IT ALSO INCLUDES A QUICK REFERENCE CHART WITH REQUIREMENTS FOR EACH TYPE OF MOTION.



## ORNAMENTAL HORTICULTURE SALESMANSHIP AND SELLING

**UNIT CONCEPT:** EFFECTIVE SELLING IN TODAY'S COMPLEX SOCIETY PROVIDES THE CORNERSTONE TO THE SUCCESS OF THE ORNAMENTAL HORTICULTURE BUSINESS WHETHER IT INVOLVES THE SELLING OF EQUIPMENT AND/OR SERVICES. ALL EMPLOYEES WHO ARE SKILLED IN THE ART OF SALESMANSHIP AND FOCUS THEIR ATTENTION ON THE NEEDS OF THE CUSTOMER CAN AID IN THE DEVELOPMENT OF A SATISFIED CUSTOMER AND IN THE BUILDING OF "REPEAT BUSINESS."

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHILE WORKING IN THE ORNAMENTAL HORTICULTURE BUSINESS, HANDLE THE OBJECTIONS AND COMPLAINTS OF A CUSTOMER TO THE SATISFACTION OF THE TEACHER AND/OR EMPLOYER.
2. WHILE WORKING IN THE ORNAMENTAL HORTICULTURE BUSINESS, FILL OUT THE APPROPRIATE SALES FORMS USED BY THE BUSINESS TO THE SATISFACTION OF THE EMPLOYER.
3. WHILE WORKING IN THE ORNAMENTAL HORTICULTURE BUSINESS, ADVERTISE AND DISPLAY ITEMS FOR SALE IN A MANNER ACCEPTABLE TO THE TEACHER AND/OR EMPLOYER.
4. UPON THE REQUEST OF THE TEACHER, DEFINE SUBSTITUTE SELLING AND RELATED SELLING AT A LEVEL OF PERFORMANCE ACCEPTABLE TO THE TEACHER.
5. WHILE WORKING IN THE ORNAMENTAL HORTICULTURE BUSINESS, MEET PROSPECTIVE CUSTOMERS AND CONDUCT A SALES PRESENTATION TO THE SATISFACTION OF THE TEACHER AND/OR EMPLOYER.

### B. INSTRUCTIONAL AREAS

1. DETERMINING THE DUTIES AND RESPONSIBILITIES OF SALES PERSONNEL IN ORNAMENTAL HORTICULTURE
  - A. SELLING DUTIES AND RESPONSIBILITIES
  - B. NONSELLING DUTIES AND RESPONSIBILITIES

- C. DETERMINING THE INFLUENCE NONSALES EMPLOYEES HAVE ON THE SALES OF A BUSINESS
- 2. ASSESSING THE ATTRIBUTES OF SUCCESSFUL SALES PERSONNEL
  - A. DETERMINING THE INFLUENCE PERSONALITY HAS ON THE SALES PROCESS
  - B. DETERMINING THE INFLUENCE THE SALESMAN'S MENTAL ATTITUDE HAS ON SELLING
  - C. ASSESSING THE IMPORTANCE A SALESMAN'S PHYSICAL APPEARANCE HAS ON SELLING
  - D. DETERMINING THE IMPORTANCE OF PRODUCT KNOWLEDGE IN THE SELLING PROCESS
- 3. ADVERTISING AND DISPLAYING ITEMS FOR SALE
  - A. PREPARING ADVERTISING ANNOUNCEMENTS FOR VARIOUS MEDIA
  - B. PREPARING DISPLAYS FOR SELLING ITEMS
- 4. APPROACHING AND MEETING THE POTENTIAL CUSTOMER
  - A. CONSIDERING FACTORS THAT ARE IMPORTANT IN GREETING THE CUSTOMER
  - B. HANDLING THE DIFFERENT KINDS OF CUSTOMERS
- 5. SECURING CUSTOMER ATTENTION AND INTEREST
  - A. DEVELOPING METHODS TO SECURE CUSTOMER INTEREST
  - B. MAINTAINING THE CUSTOMER'S INTEREST
- 6. HANDLING CUSTOMER OBJECTIONS
  - A. IDENTIFYING THE CUSTOMER'S OBJECTION SUCH AS OBJECTIONS TO PRICE, ERRONEOUS IDEAS ABOUT THE PRODUCT, LACK OF A DESIRE TO CHANGE, TIME AND SOURCE
  - B. DETERMINING HOW TO HANDLE THESE OBJECTIONS AND STILL KEEP THE CUSTOMER INTERESTED
  - C. SELLING SUBSTITUTE ITEMS AND/OR RELATED ITEMS
- 7. CLOSING THE SALE
  - A. DETERMINING WHEN TO CLOSE THE SALE

- B. USING VARIOUS TECHNIQUES FOR CLOSING THE SALE
  - C. RECORDING THE SALE AND COMPLETING THE APPROPRIATE FORMS USED BY THE BUSINESS
  - D. FOLLOWING UP THE SALE
8. HANDLING CUSTOMER COMPLAINTS AFTER THE SALE HAS BEEN COMPLETED
- A. DETERMINING WHAT THE COMPLAINT IS AND THE SOURCE OR CAUSE OF THE COMPLAINT
  - B. FOLLOWING APPROPRIATE PROCEDURES FOR HANDLING THE COMPLAINT OR REFERRING THE CUSTOMER TO APPROPRIATE PERSONNEL TO HANDLE THE COMPLAINT

C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. USING STUDENTS, SAMPLE PRODUCTS AND A DISPLAY COUNTER, ROLE PLAY THE COMPLETE SALES PROCESS FOCUSING UPON GREETING THE CUSTOMER, MAINTAINING INTEREST AND OVERCOMING CUSTOMER OBJECTIONS. HAVE THE STUDENTS DISCUSS THE VARIOUS PRESENTATIONS.
- 2. THROUGH SIMULATION PROCEDURES USING A CASH REGISTER AND APPROPRIATE SALES FORMS, CLOSE A SALE AND COMPLETE THE APPROPRIATE FORMS.
- 3. A. PREPARE A SAMPLE DIRECT MAIL ADVERTISING ITEM THAT COULD BE USED BY THE SALES DEPARTMENT IN ORNAMENTAL HORTICULTURE BUSINESSES.  
  
B. USING VARIOUS PRODUCTS AND A DISPLAY COUNTER, SET UP AN INTERESTING DISPLAY OF THE PRODUCTS FOCUSING UPON ATTENTION GETTING TECHNIQUES.
- 4. USING SIMULATION PROCEDURES, A DISPLAY COUNTER AND VARIOUS PRODUCTS, DEMONSTRATE THE USE OF SUBSTITUTE SELLING AND RELATED SALES ITEMS.
- 5. VISIT SEVERAL DIFFERENT FIRMS OR STORES AND OBSERVE THE VARIOUS APPROACHES SALES PERSONNEL USE. COMPLETE A BRIEF EVALUATION ON EACH PERSON AND COMPILE A LIST OF THE FACTORS YOU BELIEVE ARE IMPORTANT TO SUCCESSFUL SELLING.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. GIVE STUDENTS VARIOUS SITUATIONS WHICH DESCRIBE CUSTOMER OBJECTIONS OF COMPLAINTS AND HAVE STUDENTS EXPLAIN ORALLY OR IN WRITING THE TECHNIQUES OR PROCEDURES THEY WOULD USE TO HANDLE OR SOLVE THE PROBLEM. THIS ACTIVITY MUST BE EVALUATED IN RELATION TO THE PARTICULAR SITUATION.
2. GIVE STUDENTS INFORMATION ABOUT SPECIFIC SALES OR HORTICULTURAL PRODUCTS OR SUPPLIES AND COMMONLY USED FORMS AND HAVE THEM FILL OUT THE SALES FORMS USING THE GIVEN INFORMATION. THE COMPLETED FORMS SHOULD BE NEAT AND ACCURATE FOR COMPLETE ACCURACY.
3. PROVIDE STUDENTS WITH PICTURES OR DRAWINGS OF VARIOUS PRODUCT DISPLAYS AND HAVE STUDENTS IDENTIFY THE DISPLAYS WHICH ARE MOST LIKELY TO ATTRACT THE CUSTOMER'S ATTENTION AS WELL AS BEING NEAT AND ATTRACTIVE.
4. EACH STUDENT SHOULD CORRECTLY DEFINE SUBSTITUTE SELLING AND RELATED SELLING TO THE SATISFACTION OF THE INSTRUCTOR.
5. USE A ROLE PLAYING EXERCISE AND HAVE STUDENTS CONDUCT A SALE. THE STUDENT SHOULD EXHIBIT APPROPRIATE SELLING TECHNIQUES IN GREETING THE CUSTOMER, AROUSING AND MAINTAINING CUSTOMER INTEREST, PRESENTING THE PRODUCT, AND CLOSING THE SALE TO THE SATISFACTION OF THE TEACHER AND/OR EMPLOYER.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. APPROPRIATE EQUIPMENT NEEDED FOR SIMULATION OF THE SALES PROCESS SUCH AS SALES FORMS, CASH REGISTER AND DISPLAY COUNTER.
2. APPROPRIATE EXAMPLES OF AGRICULTURAL PRODUCTS SOLD IN ORNAMENTAL HORTICULTURE BUSINESSES.

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. ADVERTISING AND PROMOTION. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, 34 PAGES.

A STUDENT REFERENCE AND WORKBOOK, THIS REFERENCE SPECIFICALLY FOCUSES UPON THE PREPARATION OF ADVERTISING FOR VARIOUS MEDIA AND THE PREPARATION OF DISPLAYS. VARIOUS STUDENT ASSIGNMENTS AND EXERCISES ARE INCLUDED.

2. SALESMANSHIP IN AGRICULTURAL BUSINESS. VAS 6002. URBANA, ILLINOIS: VOCATIONAL AGRICULTURE SERVICE, UNIVERSITY OF ILLINOIS. 1972, 12 PAGES.

THIS REFERENCE WHICH IS USEFUL TO STUDENTS, PRESENTS AN OVERVIEW OF THE OPPORTUNITIES IN SALES IN AGRICULTURAL BUSINESS AND THE IMPORTANCE OF SELLING IN OUR ECONOMY. SECTIONS COVERED IN THE REFERENCE DEAL WITH THE PERSONAL CHARACTERISTICS OF SALES PERSONNEL, CONDUCTING THE SALES INTERVIEW, HANDLING OBJECTIONS AND CLOSING THE SALE.

3. SELLING AND SALESMANSHIP. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, 32 PAGES.

A STUDENT REFERENCE AND WORKBOOK, THIS REFERENCE COVERS THE AREAS OF SUCCESSFUL SELLING, THE ACTUAL SALES TRANSACTION AND THE LOST SALE. INCLUDED THROUGHOUT ARE EXERCISES WHICH THE STUDENT MAY COMPLETE ON VARIOUS TOPICS.



## EMPLOYABILITY SKILLS AND HUMAN RELATIONS

**UNIT CONCEPT:** JOB PROCUREMENT, JOB ADVANCEMENT, AND GENERAL CAREER SUCCESS ARE PROMOTED THROUGH THE DEVELOPMENT OF COMPETENT COMMUNICATION SKILLS AND GOOD HUMAN RELATIONS.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WRITE A PERSONAL RESUME AND LETTER OF APPLICATION, COMPLETE EMPLOYMENT APPLICATIONS AND CONDUCT HIMSELF IN AN INTERVIEW IN SUCH A MANNER THAT HE WILL BE ABLE TO PROCURE A JOB.
2. EFFECTIVELY CARRY ON A TELEPHONE CONVERSATION, INCLUDING INITIATING CONVERSATIONS, ANSWERING THE TELEPHONE, FORMULATING RESPONSES AND TAKING TELEPHONE MESSAGES.
3. EFFECTIVELY HANDLE A SALES PROCEDURE USING THE SIX BASIC STEPS IN SELLING ORNAMENTAL HORTICULTURE PRODUCTS AND/OR SUPPLIES.
4. IN WORKING IN AN ORNAMENTAL HORTICULTURE BUSINESS OR INDUSTRY, IMPROVE HIS RELATIONS WITH FELLOW EMPLOYEES, EMPLOYER, SUPERVISORS AND THE PUBLIC AS EVALUATED BY THE EMPLOYER USING CRITERIA SUCH AS APPEARANCE, PUNCTUALITY, DEPENDABILITY, INTEREST, JUDGMENT, PRODUCTION, INITIATIVE AND COOPERATION.

### B. INSTRUCTIONAL AREAS

1. PROCURING THE JOB
  - A. WRITING LETTERS OF APPLICATION
  - B. PREPARING PERSONAL DATA SHEETS
  - C. FILLING OUT EMPLOYMENT APPLICATIONS
  - D. INTERVIEWING
  - E. OBTAINING SOCIAL SECURITY NUMBER AND BIRTH CERTIFICATE



## 2. IMPROVING COMMUNICATIONS SKILLS

### A. COMMUNICATING VIA TELEPHONE

- (1) INITIATING A TELEPHONE CONVERSATION
- (2) ANSWERING THE TELEPHONE
- (3) LISTENING TO TELEPHONE CONVERSATION AND FORMULATING RESPONSES
- (4) TERMINATING A TELEPHONE CONVERSATION
- (5) TAKING AND DELIVERING TELEPHONE MESSAGES

### B. COMMUNICATING THOUGHTS AND FACTS CLEARLY BY WRITING

- (1) USING TECHNICAL TERMS
- (2) USING CORRECT SPELLING AND GRAMMAR

## 3. IMPROVING SALES SKILLS

### A. DEVELOPING THE APPROACH

### B. FINDING CUSTOMERS' NEEDS AND DESIRES

### C. HELPING CUSTOMERS EXAMINE THE GOODS OR SERVICES

### D. ANSWERING CUSTOMERS' QUESTIONS AND OBJECTIVES

### E. COMPLETING THE SALE

### F. SUGGESTING ADDITIONAL MERCHANDISE OR SERVICE

## 4. IMPROVING ON THE JOB

### A. KEEPING THE JOB

- (1) DEVELOPING EMPLOYER-EMPLOYEE RELATIONS
- (2) DEVELOPING SUPERVISOR-EMPLOYEE RELATIONS THROUGH GIVING AND RECEIVING CONSTRUCTIVE CRITICISM
- (3) DEVELOPING EMPLOYEE-EMPLOYEE RELATIONS
- (4) DEVELOPING CLIENT OR CUSTOMER-EMPLOYEE RELATIONS

### B. GROWING ON THE JOB

- (1) DEVELOPING EFFECTIVE WORK HABITS
- (2) IMPROVING TECHNICAL SKILLS
  - (A) PLANNING FOR ADVANCEMENT
  - (B) DEVELOPING SOCIAL CONSCIOUSNESS

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. USE ROLE PLAYING AMONG THE STUDENTS TO PRACTICE JOB INTERVIEWS.  
  
B. WRITE LETTERS REQUESTING SOCIAL SECURITY CARD AND BIRTH CERTIFICATE.
2. HAVE THE STUDENT RECORD A TELEPHONE CONVERSATION OF HIMSELF AND COMPLETE A SELF-RATING VOICE SCALE.
3. HAVE STUDENTS PARTICIPATE IN AN AGRICULTURAL SUPPLIES OR PRODUCTS SALES CAMPAIGN.
4. HAVE STUDENTS SURVEY SEVERAL ORNAMENTAL HORTICULTURE BUSINESSES OR INDUSTRIES AND INTERVIEW THE PERSONNEL DIRECTOR, MANAGER OR OWNER TO IDENTIFY FACTORS IMPORTANT TO HUMAN RELATIONS.

### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. HAVE EACH STUDENT DEVELOP A PERSONAL RESUME, WRITE LETTERS FOR JOB APPLICATION, COMPLETE JOB APPLICATION FORMS AND DISPLAY THE QUALITIES NEEDED FOR A SUCCESSFUL JOB INTERVIEW.
2. HAVE EACH STUDENT CONDUCT A SIMULATED BUSINESS TRANSACTION USING THE TELEPHONE TO THE SATISFACTION OF THE TEACHER.
3. HAVE EACH STUDENT PRESENT SUPPLIES AND/OR SERVICES TO CUSTOMERS IN A SIMULATED SETTING TO THE SATISFACTION OF THE TEACHER.
4. HAVE EACH STUDENT USE AN APPROPRIATE RATING SCALE FOR SELF-EVALUATION OF HIS HUMAN RELATIONS ABILITIES WITH EMPLOYEES, CUSTOMERS, SUPERVISORS AND EMPLOYER(S).

### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. TAPE RECORDER AND/OR VIDEO TAPE
2. TELEPHONES

### F. EXAMPLES OF SUPPORTING REFERENCES

1. HUMAN RELATIONS IN AGRI-BUSINESS. EAST LANSING, MICHIGAN: DEPARTMENT OF SECONDARY EDUCATION AND CURRICULUM, MICHIGAN STATE UNIVERSITY.

THIS PUBLICATION IS INTENDED TO BE USED AS A STUDENT MANUAL FOR INDIVIDUALIZED INSTRUCTION. INCLUDED IS A BRIEF TEXT ON VARIOUS TOPICS IN HUMAN RELATIONS FOLLOWED BY STUDENT ACTIVITIES OR EXERCISES TO EVALUATE THE STUDENT'S COMPREHENSION OF THE TOPIC DISCUSSED.

2. HUMAN RELATIONS IN BUSINESS. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, 70 PAGES.

THE STUDENT REFERENCE INCLUDES BRIEF YET COMPREHENSIVE DISCUSSIONS AND EXERCISES, INCLUDING CASES, WHICH THE STUDENT CAN READ AND COMPLETE TO OBTAIN A BETTER UNDERSTANDING OF THE HUMAN RELATIONS PROCESS.

3. RESOURCE UNIT ON HUMAN RELATIONS. TUCSON, ARIZONA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE UNIVERSITY OF ARIZONA. 1971, 90 PAGES.

IN THIS REFERENCE FOR TEACHERS, THE COMPLETE AREA OF HUMAN RELATIONS IS COVERED IN OUTLINE FORM. NUMEROUS CASE PROBLEMS ARE PRESENTED FOR STUDENTS AND TEACHERS TO CONSIDER DURING DISCUSSION PERIODS. VARIOUS RATING FORMS FOR SELF-EVALUATION ARE INCLUDED WHICH THE STUDENTS MAY COMPLETE. SAMPLE TEST ITEMS ARE ALSO INCLUDED.

## HAND AND POWER TOOLS AND HARDWARE USED IN ORNAMENTAL HORTICULTURE

**UNIT CONCEPT:** THE PROPER SELECTION, USE, AND CARE OF HAND AND POWER TOOLS WHEN REPAIRING AND SERVICING HORTICULTURE EQUIPMENT NOT ONLY WILL AID IN PERFORMING THE REPAIRS OR SERVICES IN AN EFFICIENT AND EFFECTIVE MANNER, BUT THE PROPER USE AND CARE OF THE TOOLS WILL AID IN EXTENDED TOOL LIFE.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN VARIOUS KINDS OF HAND AND POWER TOOLS USED IN ORNAMENTAL HORTICULTURE, CORRECTLY IDENTIFY THE TOOLS AND DESCRIBE THEIR USES USING PROPER TOOL NOMENCLATURE AT A LEVEL OF PERFORMANCE ESTABLISHED BY THE INSTRUCTOR.
2. WHEN PRESENTED VARIOUS KINDS OF HARDWARE COMMONLY USED ON HORTICULTURAL EQUIPMENT, CORRECTLY IDENTIFY THE HARDWARE BY USING THE PROPER NOMENCLATURE AND DESCRIBE THE USE OF THE HARWARE AT A LEVEL OF PERFORMANCE ACCEPTABLE TO THE TEACHER.
3. WHEN PROVIDED EQUIPMENT REQUIRING THE USE OF VARIOUS TOOLS AND/OR HARDWARE IN ORDER TO REPAIR OR SERVICE THE EQUIPMENT, SELECT THE PROPER TOOLS AND/OR HARDWARE TO COMPLETE THE SERVICE OR REPAIR AND USE THE TOOLS AND HARDWARE AT A LEVEL OF PERFORMANCE ACCEPTABLE TO THE INSTRUCTOR.
4. WHEN PRESENTED SELECTED ITEMS OF TOOLS IN NEED OF REPAIR OR REQUIRING GENERAL MAINTENANCE, MAKE SUCH REPAIRS OR PERFORM SUCH GENERAL MAINTENANCE PROCEDURES TO A LEVEL OF PERFORMANCE ACCEPTABLE TO THE INSTRUCTOR.
5. WHEN PROVIDED SELECTED TOOLS AND POWER EQUIPMENT, EXHIBIT SAFE OPERATING PROCEDURES FOR THE VARIOUS TOOLS TO THE SATISFACTION OF THE TEACHER OR AN EMPLOYER.

## B. INSTRUCTIONAL AREAS

1. USING HAND TOOLS COMMONLY NEEDED IN ORNAMENTAL HORTICULTURE EQUIPMENT AND MECHANICS SERVICE AND REPAIR
  - A. IDENTIFYING THE VARIOUS HAND TOOLS USING THE PROPER NOMENCLATURE SUCH AS PLIERS, WRENCHES, HAMMERS, ETC.
  - B. DETERMINING THE PROPER USES OF VARIOUS HAND TOOLS
    - (1) CONVERTING TO THE METRIC SYSTEM
  - C. OBSERVING SPECIAL SAFETY PRECAUTIONS IN USING VARIOUS HAND TOOLS
  - D. FOLLOWING GENERAL MAINTENANCE PRACTICES IN THE CARE OF VARIOUS HAND TOOLS
2. USING POWER TOOLS COMMONLY NEEDED IN ORNAMENTAL HORTICULTURE EQUIPMENT AND MECHANICS SERVICE AND REPAIR
  - A. IDENTIFYING THE VARIOUS POWER TOOLS USING THE PROPER NOMENCLATURE SUCH AS POWER DRILLS, GRINDERS, STEAM CLEANER, ETC.
  - B. DETERMINING THE PROPER USES OF VARIOUS POWER TOOLS
  - C. OBSERVING SPECIAL SAFETY PRECAUTIONS IN OPERATING VARIOUS POWER TOOLS
  - D. FOLLOWING APPROVED PRACTICES IN THE ADJUSTMENT, MAINTENANCE, AND CARE OF POWER TOOLS.
3. USING SPECIALIZED TOOLS AND EQUIPMENT NEEDED IN ORNAMENTAL HORTICULTURE EQUIPMENT AND MECHANICS SERVICE AND REPAIR
  - A. IDENTIFYING THE VARIOUS SPECIALIZED MECHANICS TOOLS AND EQUIPMENT SUCH AS TIMING LIGHTS, TACHOMETER, DYNAMOMETER, ETC.
  - B. DETERMINING THE PROPER USES OF SUCH SPECIALIZED EQUIPMENT
  - C. OBSERVING SPECIAL SAFETY PRECAUTIONS IN OPERATING AND USING SUCH SPECIALIZED EQUIPMENT
  - D. FOLLOWING APPROVED PRACTICES IN THE ADJUSTMENT, MAINTENANCE, AND CARE OF SPECIALIZED MECHANICS TOOLS AND EQUIPMENT

#### 4. USING HARDWARE IN AGRICULTURAL EQUIPMENT

- A. IDENTIFYING VARIOUS HARDWARE ITEMS USED ON AGRICULTURAL EQUIPMENT
- B. DETERMINING THE PROPER USE OF VARIOUS ITEMS OF HARDWARE
- C. PROCEDURES TO FOLLOW IN USING VARIOUS HARDWARE ITEMS FOR SERVICING OR REPAIRING AGRICULTURAL EQUIPMENT

#### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. USE PICTURES, SLIDES OR ACTUAL HAND AND POWER TOOLS AND HAVE STUDENTS PRACTICE IDENTIFYING THE TOOLS.
- 2. HAVE STUDENTS MAKE A DISPLAY BOARD OF COMMONLY USED HARDWARE FOR DISPLAY IN THE SHOP OR LABORATORY.
- 3. STUDENTS SHOULD PRACTICE OPERATING THE POWER TOOLS COMMONLY USED IN THE HORTICULTURAL INDUSTRY.
- 4. HAVE EACH STUDENT RECONDITION, SHARPEN OR REPAIR HAND TOOLS OR EQUIPMENT SUCH AS CHISELS, MOWER BLADES, GRAFTING KNIVES AND OTHER COMMONLY USED EQUIPMENT. THE TOOLS USED IN THIS ACTIVITY SHOULD BE THAT USED IN THE PARTICULAR PROGRAM OFFERED SUCH AS TURF, NURSERY, ETC.
- 5. HAVE GROUPS OF STUDENTS GIVE CLASS DEMONSTRATIONS ON THE SAFE PROCEDURES FOR USING AND OPERATING HAND AND POWER TOOLS.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

- 1. USE FLASH CARDS OR ACTUAL EQUIPMENT AND HAVE STUDENTS IDENTIFY EACH PIECE OF EQUIPMENT BY NAME AND USE IN THE HORTICULTURAL INDUSTRY. STUDENTS SHOULD BE ABLE TO HAVE MASTERY OF FIFTY HAND TOOLS AND THIRTY PIECES OF POWER TOOLS OR EQUIPMENT.
- 2. DEVELOP A MATCHING TEST WITH NAMES OF VARIOUS KINDS OF HARDWARE COMMONLY USED WITH HORTICULTURAL EQUIPMENT IN ONE COLUMN AND HAVE STUDENTS MATCH THE NAME WITH ANOTHER COLUMN WHICH LISTS THE USE OF THE HARDWARE. THIS ACTIVITY SHOULD BE COMPLETED WITH 95% ACCURACY.



3. GIVE STUDENTS ACTUAL SITUATIONS AND EQUIPMENT WHICH ARE IN NEED OF REPAIR, AND HAVE THEM IDENTIFY AND SELECT THE PROPER TOOLS AND/OR HARDWARE NEEDED TO COMPLETE THE SERVICE OR REPAIR TO THE SATISFACTION OF THE INSTRUCTOR.
4. HAVE STUDENTS DESCRIBE THE PROCEDURES NECESSARY TO REPAIR OR MAINTAIN A PARTICULAR HAND OR POWER TOOL WITH COMPLETE ACCURACY. THEY SHOULD ALSO BE REQUIRED TO ACTUALLY PERFORM THESE PROCEDURES.
5. GIVE STUDENTS VARIOUS PIECES OF POWER EQUIPMENT AND HAVE THEM LIST THE SAFETY PRECAUTIONS OR PROCEDURES TO BE FOLLOWED TO OPERATE THE EQUIPMENT SAFELY. THE STUDENT SHOULD BE EVALUATED ON THE BASIS OF WHETHER THE CRITICAL FACTORS ARE LISTED.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. A COMPLETE LINE OF HAND AND POWER TOOLS COMMONLY NEEDED IN AN ORNAMENTAL HORTICULTURE HIGH SCHOOL PROGRAM
2. A COMPLETE LINE OF HARDWARE ITEMS COMMONLY USED IN SERVICING AND MAINTAINING HORTICULTURAL EQUIPMENT
3. METAL OF VARIOUS SIZES FOR THE STUDENTS TO WORK WITH.

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. ABC'S OF HAND TOOLS. DETROIT, MICHIGAN: GENERAL MOTORS CORPORATION. 1973.  
  
A WELL ILLUSTRATED PUBLICATION, IT COVERS THE BASIC USES OF HAND TOOLS AND THEIR PRACTICAL APPLICATION TO THE AREA OF MECHANICS.
2. FUNDAMENTALS OF SERVICE: SHOP TOOLS. MOLINE, ILLINOIS: DEPARTMENT F, JOHN DEERE SERVICE PUBLICATION. 1971, 36 PAGES.  
  
WELL ILLUSTRATED, THIS PUBLICATION COVERS NUMEROUS HAND AND SPECIALIZED TOOLS AND ILLUSTRATES THEIR PROPER USE IN A MANNER THAT STUDENTS WILL FIND EASY TO FOLLOW.
3. POWER TOOL SAFETY AND OPERATION: WOODWORKING, METALWORKING, METALS AND WELDING. ST. PAUL, MINNESOTA: HOBAR PUBLICATIONS. 1973, 96 PAGES.

THIS PUBLICATION COVERS THE OPERATIONAL PROCEDURES AND GENERAL SAFETY PRECAUTIONS THAT SHOULD BE OBSERVED IN OPERATING VARIOUS ITEMS OF EQUIPMENT IN A CONCISE MANNER.

4. PRINCIPLES AND PRACTICE OF PRECISION MEASUREMENT. NORTH KINGSTOWN, RHODE ISLAND: BROWN AND SHARPE MANUFACTURING CO. 1967, 56 PAGES.

AN INSTRUCTOR'S GUIDE, THIS REFERENCE OUTLINES IN DETAIL VARIOUS LESSON PLANS THAT THE TEACHER MAY FIND HELPFUL IN PREPARING STUDENTS TO WORK WITH VARIOUS PRECISION MEASUREMENT INSTRUMENTS.

5. TODD, JOHN D. USE AND ADJUSTMENT OF SELECTED STATION-ARY SHOP EQUIPMENT. KNOXVILLE, TENNESSEE: AGRICULTURAL EDUCATION DEPARTMENT, THE UNIVERSITY OF TENNESSEE. 1968, 30 PAGES.

MORE USEFUL AS A TEACHER'S REFERENCE THAN AS A STUDENT REFERENCE, THIS PUBLICATION COVERS THE BASIC OPERATING AND SAFETY PRECAUTIONS TO USE WITH VARIOUS ITEMS OF EQUIPMENT.

6. TOOL IDENTIFICATION MANUAL. SAN LUIS OBISPO, CALIFORNIA: VOCATIONAL EDUCATION PRODUCTIONS, CALIFORNIA STATE POLYTECHNIC COLLEGE. 1970, 32 PAGES.

INCLUDED IN THIS PUBLICATION ARE PICTURES OF VARIOUS HAND AND POWER TOOLS WITH A BRIEF DESCRIPTION OF THE USE OF THE TOOL. VARIOUS TYPES OF HARDWARE ITEMS ARE ALSO COVERED IN A SIMILAR MANNER.

## OPERATION AND CARE OF SMALL GASOLINE ENGINES

**UNIT CONCEPT:** PROPER STARTING, OPERATION, CLEANING, AND STORAGE OF SMALL GASOLINE ENGINES WILL RESULT IN INCREASED ENGINE EFFICIENCY AND LONGER LIFE WITH A MINIMUM OF ANNOYANCE AND EXPENSE.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. IDENTIFY THE TWO BASIC TYPES OF SMALL GASOLINE ENGINES AND EXPLAIN THEIR PRINCIPLES OF OPERATION WITH ACCURACY NEEDED TO DIFFERENTIATE BETWEEN THEM.
2. USE THE PROPER PROCEDURES FOR PREPARING TO START AND STARTING A SMALL GASOLINE ENGINE INCLUDING REFUELING TO PREVENT STARTING TROUBLES AND ACCIDENTS.
3. OPERATE, ADJUST ENGINE SPEED AND LOAD, AND STOP SMALL GASOLINE ENGINES USING PROCEDURES WHICH PROMOTE OPTIMUM ENGINE EFFICIENCY AND OPERATOR SAFETY.
4. PROPERLY CLEAN A SMALL GASOLINE ENGINE TO PREVENT OVERHEATING AND EXCESSIVE WEAR DUE TO DIRT ENTERING THE ENGINE.
5. PREPARE A SMALL GASOLINE ENGINE PROPERLY FOR STORAGE OF THREE OR MORE MONTHS DURATION TO PREVENT CORROSION AND DAMAGE.

### B. INSTRUCTIONAL AREAS

1. IDENTIFYING TYPES OF SMALL GASOLINE ENGINES
  - A. IDENTIFYING OPERATING PRINCIPLES OF FOUR-STROKE-CYCLE ENGINES
  - B. IDENTIFYING OPERATING PRINCIPLES OF TWO-STROKE-CYCLE ENGINES
  - C. IDENTIFYING SPECIFIC USES OF EACH TYPE OF ENGINE
2. PREPARING SMALL GASOLINE ENGINES FOR STARTING
  - A. REFUELING

- (1) SELECTING THE FUEL
- (2) MIXING THE OIL-GASOLINE MIXTURE FOR A TWO-STROKE-CYCLE ENGINE
- (3) FILLING THE TANK USING PROPER SAFETY PRECAUTIONS

#### B. STARTING

- (1) IDENTIFYING SAFETY PRECAUTIONS
- (2) CHECKING REQUIRED SERVICING
- (3) OPERATING STARTING MECHANISMS

### 3. OPERATING A SMALL GASOLINE ENGINE

- A. SELECTING PROPER SPEED
- B. SELECTING PROPER LOAD
- C. CORRELATING ENGINE TYPE TO SLOPE AND OTHER WORKING CONDITIONS
- D. STOPPING THE ENGINE

### 4. CLEANING SMALL GASOLINE ENGINES

- A. CLEANING THE OUTSIDE OF THE ENGINES
- B. CLEANING THE MUFFLER AND/OR EXHAUST PORTS
- C. CLEANING THE COOLING SYSTEM

### 5. STORING THE ENGINE

- A. PREVENTING CORROSION AND MOISTURE BUILD-UP
- B. PREVENTING GUM DEPOSITS
- C. PREVENTING DUST BUILD-UP AND PHYSICAL DAMAGE

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. USE CUT AWAY MODELS OF TWO AND FOUR CYCLE ENGINES TO OBSERVE DIFFERENCES IN THEIR OPERATING PRINCIPLES.
- 2.
  - A. MAKE A CHECK LIST OF SAFETY PROCEDURES TO FOLLOW BEFORE, DURING, AND AFTER STARTING A SMALL ENGINE.
  - B. PREPARE A FUEL MIXTURE FOR A TWO-STROKE-CYCLE ENGINE.
- 3. COMPARE OPERATING INSTRUCTIONS IN OPERATOR'S MANUALS OF TWO AND FOUR-STROKE-CYCLE ENGINES AND NOTE DIFFERENCES IN RECOMMENDATIONS.

4. BRING IN EXAMPLES OF POORLY CARED FOR ENGINES FOR THE STUDENTS TO CLEAN.
5. USE A SMALL GASOLINE ENGINE THAT WILL BE STORED FOR A LONG PERIOD OF TIME TO DEMONSTRATE CORRECT PROCEDURES TO USE TO PREPARE AN ENGINE FOR STORAGE.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. DEVELOP AN ESSAY TEST IN WHICH THE STUDENTS WILL INDICATE THE BASIC DIFFERENCES BETWEEN TWO AND FOUR-STROKE-CYCLE ENGINES.
2. HAVE THE STUDENTS LIST THE PROCEDURES TO FOLLOW WHEN REFUELING SMALL GASOLINE ENGINES WHICH SHOULD INCLUDE SAFETY PRECAUTIONS.
3. HAVE EACH STUDENT OPERATE A SMALL GASOLINE ENGINE UNDER WORKING CONDITIONS. EVALUATE THE STUDENT IN RELATION TO PROPER LOAD AND SPEED ADJUSTMENT AND SAFETY PROCEDURES.
4. HAVE THE STUDENTS LIST THE PROCEDURES THAT SHOULD BE FOLLOWED WHICH WILL HELP PREVENT ENTRANCE OF DIRT INTO THE ENGINE.
5. HAVE THE STUDENTS DESCRIBE THE PROCEDURE THEY WOULD FOLLOW TO PREPARE A SMALL GASOLINE ENGINE FOR STORAGE.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. SMALL ENGINE HAND TOOLS
2. CUT-AWAY MODELS OF TWO AND FOUR-STROKE-CYCLE ENGINES
3. AIR COMPRESSOR
4. "DEGREASER" SOLVENTS
5. SMALL ENGINES IN GOOD AND POOR CONDITION

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. SMALL ENGINES. VOLUME I. ATHENS, GEORGIA: ENGINEERING CENTER, AMERICAN ASSOCIATION FOR VOCATIONAL INSTRUCTIONAL MATERIALS. 1968, 150 PAGES.

THIS BOOKLET CONTAINS A COMPLETE DISCUSSION OF PROCEDURES FOR OPERATING AND CARING FOR SMALL GASOLINE ENGINES AND WOULD BE OF VALUE AS A STUDENT TEXT.

## MAINTENANCE OF SMALL GASOLINE ENGINES

**UNIT CONCEPT:** REGULAR MAINTENANCE WHICH INCLUDES CLEANING THE CARBURETOR AIR CLEANER, CLEANING THE FUEL STRAINER, SELECTING AND CHANGING CRANKCASE OIL, AND SERVICING THE SPARK PLUG IS NEEDED TO OBTAIN TROUBLE-FREE SERVICE, GREATER ENGINE EFFICIENCY, AND LONGER LIFE FROM SMALL GASOLINE ENGINES.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. IDENTIFY THE DIFFERENT TYPES OF CARBURETOR AIR CLEANERS COMMONLY FOUND ON SMALL GASOLINE ENGINES AND CLEAN AND SERVICE THEM ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
2. IDENTIFY THE THREE BASIC TYPES OF FUEL STRAINERS COMMONLY FOUND ON SMALL GASOLINE ENGINES AND CLEAN AND SERVICE THEM ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
3. SELECT THE RIGHT OIL, KEEP THE PROPER CRANKCASE OIL LEVEL, AND CHANGE THE OIL IN A FOUR-STROKE-CYCLE ENGINE ACCORDING TO MANUFACTURER'S SPECIFICATIONS FOR SMALL GASOLINE ENGINES.
4. SELECT AND SERVICE THE SPARK PLUG ON TWO AND FOUR-STROKE-CYCLE ENGINES ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
5. IDENTIFY THE PRINCIPLES OF CARBURETOR OPERATION IN SMALL GASOLINE ENGINES AND MAKE CARBURETOR ADJUSTMENTS FOR MOST EFFICIENT PERFORMANCE.

### B. INSTRUCTIONAL AREAS

#### 1. SERVICING CARBURETOR AIR CLEANERS

##### A. IDENTIFYING THE TYPES OF CARBURETOR AIR CLEANERS

- (1) OIL-BATH TYPE
- (2) OILED-FILTER TYPE



- (3) DRY-FILTER TYPE
- B. IDENTIFYING REASONS FOR SERVICING AIR CLEANERS
- C. IDENTIFYING METHODS OF SERVICING EACH AIR CLEANER TYPE
- 2. SERVICING FUEL STRAINERS
  - A. IDENTIFYING TYPES OF FUEL STRAINERS
  - B. IDENTIFYING PROCEDURES FOR CLEANING FUEL STRAINERS
- 3. LUBRICATING FOUR-STROKE-CYCLE ENGINES
  - A. DETERMINING THE IMPORTANCE OF PROPER LUBRICATION
  - B. SELECTING CRANKCASE OIL
    - (1) SINGLE VISCOSITY OILS
    - (2) MULTI-VISCOSITY OILS
  - C. CHANGING CRANKCASE OIL
  - D. CHECKING CRANKCASE OIL LEVEL
- 4. SERVICING SPARK PLUGS
  - A. IDENTIFYING THE TYPES OF SPARK PLUGS
    - (1) HOT AND COLD PLUGS
    - (2) LENGTH OF REACH
  - B. SELECTING THE PROPER PLUG TO MEET ENGINE CONDITIONS
  - C. INSPECTING AND MAINTAINING SPARK PLUGS
- 5. ADJUSTING CARBURETORS
  - A. IDENTIFYING THE BASIC PRINCIPLES OF CARBURETION
  - B. IDENTIFYING THE COMMON TYPES OF SMALL GASOLINE ENGINE CARBURETORS
  - C. MAKING CARBURETOR ADJUSTMENTS
    - (1) IDLE SPEED SCREW
    - (2) LOW SPEED NEEDLE
    - (3) HIGH SPEED NEEDLE

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. DEMONSTRATE THE EFFECTS OF A DIRTY AIR CLEANER ON ENGINE PERFORMANCE BY PARTIALLY BLOCKING THE AIR INTAKE TO THE CARBURETOR AND LISTENING TO THE RESULTING ENGINE PERFORMANCE AND OBSERVING THE EFFECTS ON THE ENGINE'S POWER.
2. PRACTICE CLEANING DIFFERENT TYPES OF FUEL STRAINERS.
3. A. CONDUCT A DEMONSTRATION USING VARIOUS VISCOSITY GRADES OF OIL AND DETERGENT AND NON-DETERGENT OIL TO INDICATE DIFFERENCES IN OIL PERFORMANCE UNDER DIFFERENT ENGINE CONDITIONS.  
  
B. CHANGE THE OIL IN A FOUR-STROKE-CYCLE ENGINE.
4. CLEAN AND SET A SPARK PLUG ACCORDING TO THE OPERATOR'S MANUAL USING A FEELER GAUGE.
5. A. DETERMINE IF THE CARBURETOR ON A SMALL GASOLINE ENGINE IS FUNCTIONING PROPERLY BY STARTING THE ENGINE AND OBSERVING PERFORMANCE AND EXHAUST WHEN THE THROTTLE IS RAPIDLY ADVANCED.  
  
B. PRACTICE ADJUSTING ENGINE CARBURETORS ACCORDING TO MANUFACTURER'S SPECIFICATIONS AND OBSERVING ENGINE PERFORMANCE.

### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. HAVE EACH STUDENT SERVICE AN AIR CLEANER ON A SMALL GASOLINE ENGINE. EVALUATE THE STUDENT ON HIS CORRECTNESS OF PROCEDURE.
2. HAVE EACH STUDENT LIST THE STEPS TO FOLLOW WHEN SERVICING THE FUEL STRAINER ON A SMALL GASOLINE ENGINE.
3. HAVE EACH STUDENT LIST THE STEPS IN CHANGING OIL IN A SMALL GASOLINE ENGINE.
4. GIVE EACH STUDENT A DIRTY OR WORN SPARK PLUG TO SERVICE OR REPLACE. EVALUATE THE STUDENT ON CORRECTNESS OF PROCEDURE IN SERVICING THE PLUG OR ON SELECTING THE APPROPRIATE REPLACEMENT PLUG.
5. MAKE MALADJUSTMENTS ON A SMALL ENGINE CARBURETOR. HAVE EACH STUDENT RESET THE CARBURETOR SO THAT IT RUNS SMOOTHLY AND EFFICIENTLY. EVALUATE THE STUDENT AS TO CORRECTNESS IN PROCEDURE AND THE RESULTING CARBURETOR AND ENGINE PERFORMANCE.

## E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. SMALL GASOLINE ENGINES
2. COMMON SMALL GASOLINE ENGINE HAND TOOLS
3. SPARK PLUG FEELER GAUGE
4. CONTAINERS FOR WASHING PARTS
5. DIFFERENT TYPES AND GRADES OF OIL
6. PETROLEUM SOLVENT
7. EXAMPLES OF SPARK PLUGS
8. OPERATOR'S MANUALS
9. IGNITION FILE

## F. EXAMPLES OF SUPPORTING REFERENCES

1. SMALL ENGINES. VOLUME I. ATHENS, GEORGIA: ENGINEERING CENTER, AMERICAN ASSOCIATION OF VOCATIONAL INSTRUCTIONAL MATERIALS. 1968, 150 PAGES.

THIS BOOKLET CONTAINS A COMPLETE DISCUSSION OF MAINTENANCE PROCEDURES FOR SMALL GASOLINE ENGINES AND WOULD BE VALUABLE AS A STUDENT TEXT.

## OPERATION AND MAINTENANCE OF GASOLINE AND DIESEL POWER UNITS

**UNIT CONCEPT:** REGULAR MAINTENANCE OF POWER UNITS INCLUDING DAILY LUBRICATION, MAINTENANCE OF THE OIL AND COOLING SYSTEMS, AND PROPER OPERATION OF THE UNITS WILL RESULT IN GREATER ENGINE EFFICIENCY, LONGER ENGINE LIFE AND INCREASED OPERATOR SAFETY.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. IDENTIFY THE PRINCIPLES OF OPERATION OF GASOLINE AND DIESEL POWER UNITS WITH ACCURACY NEEDED TO DETERMINE WHICH TYPE OF ENGINE A SPECIFIED UNIT HAS.
2. SELECT AND MAINTAIN BATTERIES FOR POWER UNITS INCLUDING USE OF A HYDROMETER TO TEST BATTERY ELECTRICAL CONDITION AND TO OBTAIN OPTIMUM BATTERY PERFORMANCE WITH A MINIMUM OF UNNECESSARY WEAR OR DAMAGE.
3. IDENTIFY PARTS OF POWER UNITS REQUIRING FREQUENT GREASING, SELECT GREASE AND GREASE UNITS ACCORDING TO SPECIFICATIONS IN THE OPERATOR'S MANUAL.
4. MAINTAIN DRY-TYPE AND OIL BATH AIR CLEANERS ACCORDING TO OPERATOR'S MANUAL SPECIFICATIONS.
5. SELECT APPROPRIATE OIL, MAINTAIN OIL LEVELS AND CHANGE OIL WHEN NECESSARY IN THE CRANKCASE, TRANSMISSION AND HYDRAULIC SYSTEMS IN GASOLINE AND DIESEL POWER UNITS ACCORDING TO THE OPERATOR'S MANUAL.
6. MAINTAIN THE COOLING SYSTEM ON GASOLINE AND DIESEL POWER UNITS TO PREVENT FREEZING, OVERHEATING, CORROSION AND DEPOSITS.
7. SELECT AND MAINTAIN SPARK PLUGS FOR GASOLINE POWER UNITS ACCORDING TO THE MANUFACTURER'S SPECIFICATIONS.
8. REFUEL GASOLINE AND DIESEL POWER UNITS IN A MANNER WHICH WILL AVOID FIRE HAZARDS AND FOREIGN MATERIAL IN THE FUEL SYSTEM.

9. SAFELY START, OPERATE AND STOP TRACTORS, CRAWLERS AND OTHER COMMONLY USED POWER UNITS AS DIRECTED IN THE OPERATORS' MANUALS.

## B. INSTRUCTIONAL AREAS

1. IDENTIFYING PRINCIPLES OF ENGINE OPERATION
  - A. IDENTIFYING PRINCIPLES OF GASOLINE ENGINES
  - B. IDENTIFYING PRINCIPLES OF DIESEL ENGINES
2. SERVICING BATTERIES
  - A. SELECTING REPLACEMENT BATTERIES
    - (1) DETERMINING POWER REQUIREMENTS
    - (2) DETERMINING OPERATING CONDITIONS
  - B. MAINTAINING BATTERIES
    - (1) MAINTAINING LIQUID LEVEL
    - (2) MAINTAINING TERMINALS AND CLAMPS
    - (3) USING A HYDROMETER TO CHECK ELECTRICAL CONDITION
    - (4) RECHARGING BATTERIES
3. GREASING POWER UNITS
  - A. SELECTING GREASE
  - B. IDENTIFYING PARTS REQUIRING GREASE
  - C. LOCATING GREASE FITTINGS
  - D. USING A GREASE GUN
  - E. DEVELOPING A LUBRICATION SCHEDULE
4. MAINTAINING AIR CLEANERS
  - A. MAINTAINING DRY TYPE CLEANERS
  - B. MAINTAINING OIL BATH TYPE CLEANERS
5. MAINTAINING THE HYDRAULIC, TRANSMISSION AND CRANKCASE OIL SYSTEMS
  - A. SELECTING OIL
  - B. MAINTAINING PROPER OIL LEVEL

- C. CHANGING OIL
- D. CHANGING OIL FILTERS
- 6. MAINTAINING THE COOLING SYSTEM
  - A. SELECTING COOLANT
  - B. MAINTAINING PROPER COOLANT LEVEL
  - C. PREVENTING CORROSION AND DEPOSITS
  - D. PREVENTING FREEZING AND OVERHEATING
  - E. CLEANING THE COOLING SYSTEM
- 7. MAINTAINING SPARK PLUGS
  - A. SELECTING SPARK PLUGS TO MEET ENGINE SPECIFICATIONS
  - B. CLEANING AND CONDITIONING PLUGS
  - C. SETTING THE GAP
- 8. REFUELING GASOLINE AND DIESEL UNITS
  - A. SELECTING FUEL
  - B. KEEPING OUT DIRT AND MOISTURE
  - C. AVOIDING FIRE HAZARDS
  - D. REMOVING WATER FROM DIESEL FUEL SYSTEMS
- 9. OPERATING GASOLINE AND DIESEL POWER UNITS
  - A. STARTING GASOLINE AND DIESEL UNITS
    - (1) IDENTIFYING SAFETY PRECAUTIONS
    - (2) IDENTIFYING STARTING PROCEDURES
  - B. OPERATING POWER UNITS
    - (1) IDENTIFYING SAFETY PRECAUTIONS
    - (2) OPERATING POWER TAKE-OFF EQUIPMENT
    - (3) HITCHING EQUIPMENT TO TRACTORS, CRAWLERS AND OTHER UNITS
    - (4) ADJUSTING ENGINE SPEED TO LOAD
    - (5) OPERATING POWER UNITS UNDER VARYING FIELD CONDITIONS



### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. OBSERVE GASOLINE AND DIESEL UNITS TO COMPARE DIFFERENCES IN METHODS OF SUPPLYING FUEL TO THE CYLINDERS, IGNITION SYSTEMS, ETC.
2. A. USE A HYDROMETER TO PRACTICE CHECKING THE ELECTRICAL CONDITION OF BATTERIES WHICH HAVE BEEN USED UNDER VARYING FIELD CONDITIONS.  
  
B. CONSTRUCT A SIMPLE BATTERY USING A BEAKER, SULFURIC ACID SOLUTION, AND ZINC AND COPPER STRIPS. USE VOLT-METERS AND AMMETERS TO MEASURE VOLTAGE AND AMPERAGE PRODUCED.
3. HAVE THE STUDENTS DIAGRAM THE POWER UNITS THEY WILL BE WORKING WITH AND INDICATE THE LOCATION OF THE GREASE FITTINGS NEEDING FREQUENT GREASING.
4. HAVE PAIRS OF STUDENTS DEMONSTRATE TO THE REMAINDER OF THE CLASS HOW TO SERVICE EACH TYPE OF AIR CLEANER FOUND ON GASOLINE AND DIESEL POWER UNITS.
5. COMPARE OIL VISCOSITY, GRADE, ETC., USED IN THE HYDRAULIC, TRANSMISSION AND CRANKCASE OIL SYSTEMS TO INDICATE THE IMPORTANCE OF CORRECT OIL SELECTION.
6. A. PLACE A THERMOSTAT IN HOT AND COLD WATER TO INDICATE HOW IT CONTROLS ENGINE COOLANT TEMPERATURE.  
  
B. SET UP A DEMONSTRATION WITH COOLANT AND TWO OR MORE DIFFERENT METALS SUCH AS STAINLESS STEEL, BRASS, SOLDER OR ALUMINUM AND COPPER CONNECTED BY A COPPER WIRE. OBSERVE THE BATTERY ACTION WHICH CAUSES ONE OF THE METALS TO BE EATEN AWAY.
7. USE A SPARK PLUG GAUGE TO PRACTICE SETTING THE GAP ON SPARK PLUGS.
8. A. MIX WATER AND DIESEL FUEL TOGETHER AND GASOLINE AND WATER TO OBSERVE THE DIFFERENCES IN SETTING OUT OF THE WATER AND TO EMPHASIZE THE IMPORTANCE OF DRAINING OFF WATER FROM A DIESEL ENGINE BEFORE STARTING.  
  
B. DEVELOP A HOME SYSTEM OF STORING FUELS AND LUBRICANTS OBSERVING NECESSARY SAFETY PRECAUTIONS.
9. A. OBTAIN STATISTICS WHICH INDICATE NUMBERS OF AGRICULTURALLY-RELATED ACCIDENTS EACH YEAR AND THEIR CAUSES. DETERMINE WHICH ONES MIGHT HAVE BEEN PREVENTED BY OBSERVING SAFETY PRECAUTIONS DURING STARTING, OPERATING OR STOPPING OF POWER UNITS.

B. HAVE STUDENTS ENROLL IN VOCATIONAL AGRICULTURE OR 4-H TRACTOR SAFETY PROGRAM.

C. HAVE STUDENTS OPERATE TRACTORS, CRAWLERS, ETC., UNDER VARIOUS CONDITIONS BY SETTING UP A COURSE THROUGH WHICH THE STUDENTS MUST MANEUVER TO DEMONSTRATE THEIR ABILITIES.

D. USE AN ELECTRIC DRILL TO DEMONSTRATE POWER TAKE-OFF SAFETY.

E. USE MODEL TRACTORS AND CRAWLERS TO DEMONSTRATE HOW TIPPING ACCIDENTS OCCUR.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. PRESENT THE STUDENT WITH DESCRIPTIONS OF A NUMBER OF ENGINES. HAVE THE STUDENT INDICATE FROM THE DESCRIPTION WHETHER IT IS A GASOLINE OR DIESEL POWER UNIT.
2. HAVE EACH STUDENT TEST A BATTERY USING A HYDROMETER WITH EVALUATION TO BE BASED ON CORRECTNESS OF PROCEDURE AND ACCURACY.
3. GIVE THE STUDENTS A DIAGRAM OF A COMMONLY USED TRACTOR OR CRAWLER. HAVE THEM INDICATE ON THE DIAGRAM THE APPROXIMATE LOCATION OF THE GREASE FITTINGS WITH A MINIMUM OF 90% ACCURACY.
4. HAVE EACH STUDENT SERVICE A DRY TYPE OF OIL BATH AIR CLEANER FOR EVALUATION. PROCEDURES USED SHOULD BE THOSE INDICATED IN THE OPERATOR'S MANUAL.
5. HAVE EACH STUDENT CHANGE THE OIL AND OIL FILTER, IF NECESSARY, ON A POWER UNIT. EVALUATE THE STUDENT AS TO CORRECTNESS OF PROCEDURE AND SELECTION OF THE APPROPRIATE OIL AND FILTER.
6. HAVE THE STUDENTS LIST THE CORRECT PROCEDURES FOR MAINTAINING AN ENGINE COOLING SYSTEM WHICH WILL PREVENT OVERHEATING, FREEZING, CORROSION AND DEPOSITS.
7. GIVE EACH STUDENT DIRTY OR WORN SPARK PLUGS TO SERVICE. THE PLUG GAP SHOULD BE WITHIN  $\pm .002$ " OF THE SETTING RECOMMENDED IN THE OPERATOR'S MANUAL.
8. HAVE THE STUDENTS LIST THE PROCEDURES THAT SHOULD BE FOLLOWED WHEN REFUELING A GASOLINE OR DIESEL POWER UNIT. THE PROCEDURES LISTED SHOULD INCLUDE SAFETY PROCEDURES AS WELL AS THOSE WHICH WOULD HELP PROTECT THE FUEL SYSTEM FROM WATER AND OTHER FOREIGN MATTER.

9. HAVE EACH STUDENT DRIVE A TRACTOR OR CRAWLER AND IMPLEMENT THROUGH A COURSE WHICH WOULD REQUIRE OPERATOR SKILLS COMPARABLE TO THOSE NEEDED IN THE FIELD. EVALUATE THE STUDENT ON HIS SKILLS AND OBSERVANCE OF SAFETY PRECAUTIONS.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. HYDROMETER
2. BEAKER
3. METAL STRIPS - ZINC, COPPER, STAINLESS STEEL, BRASS, SOLDER
4. SULFURIC ACID SOLUTION
5. COOLANT
6. VARIOUS TYPES OF OIL
7. SPARK PLUG FEELER GAUGE
8. VOLTMETERS AND AMMETERS
9. THERMOSTAT
10. ELECTRIC DRILL
11. MODELS OF TRACTORS AND CRAWLERS
12. TRACTOR AND/OR CRAWLER
13. BATTERIES
14. GREASE GUN AND GREASE
15. WRENCHES, SOCKETS AND OTHER ENGINE TOOLS

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. OPERATING FARM TRACTORS AND MACHINERY, EFFICIENTLY, SAFELY. AMES, IOWA: PUBLICATIONS DISTRIBUTION CENTER, IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY. 1969, 81 PAGES.

ALTHOUGH THIS PUBLICATION IS ORIENTED TOWARD FARM TRACTOR AND MACHINERY OPERATION, THE MATERIAL PROVIDES PRINCIPLES OF OPERATION WHICH WOULD APPLY TO MOST SITUATIONS WHERE POWER UNITS AND EQUIPMENT ARE BEING USED.

2. TRACTOR MAINTENANCE. ATHENS, GEORGIA: ENGINEERING CENTER, AMERICAN ASSOCIATION FOR VOCATIONAL INSTRUCTIONAL MATERIALS. 1970, 145 PAGES.

THIS BOOKLET IS DESIGNED TO PROVIDE MAINTENANCE INFORMATION FOR TRACTORS, BUT WOULD BE USEFUL FOR WORK WITH MOST POWER UNITS.

3. TRACTOR OPERATION AND DAILY CARE. ATHENS, GEORGIA: ENGINEERING CENTER, AMERICAN ASSOCIATION FOR VOCATIONAL INSTRUCTIONAL MATERIALS. 1967, 120 PAGES.

THIS BOOKLET WOULD BE A VALUABLE STUDENT REFERENCE. IT CONTAINS INFORMATION THAT WOULD BE USEFUL IN OPERATING AND CARING FOR GASOLINE AND DIESEL POWER UNITS.

## II

ARBORICULTURE  
U.S.O.E. CODE 01.05 01 00 00

IDENTIFICATION AND SELECTION OF TREES AND SHRUBS  
PLANTING TREES AND SHRUBS  
APPLICATION OF FERTILIZER TO TREES  
PRUNING TREES, SHRUBS AND HEDGES  
TREE MAINTENANCE PROCEDURES

## IDENTIFICATION AND SELECTION OF TREE AND SHRUBS

**UNIT CONCEPT:** TREES AND SHRUBS HAVE A VARIETY OF CHARACTERISTICS WHICH LEND THEMSELVES TO VARYING ENVIRONMENTAL AND LANDSCAPE PLANNING CONDITIONS AND NEEDS. AN UNDERSTANDING OF THE TREE'S CHARACTERISTICS TOWARD ENVIRONMENTAL ADAPTATION AND MEETING LANDSCAPE PLANNING WILL DEFINE PLANTS WHICH WILL PROVIDE PLEASING EFFECT OF FUNCTIONAL LANDSCAPE PURPOSE ALONG WITH APPROPRIATE ADAPTATION TO AN EXISTING ENVIRONMENT.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A GROUP OF TREES AND SHRUBS COMMON TO THE AREA, CORRECTLY IDENTIFY EACH BY COMMON NAME OR BY SCIENTIFIC NAME WITH THE AID OF REFERENCES OR AN IDENTIFICATION KEY.
2. WHEN GIVEN SETS OF LANDSCAPING PLANS THAT CALL FOR PLANTS BY PHYSICAL SIZE AND A TREE AND SHRUB LIST, SPECIFY THOSE PLANTS THAT WILL FIT THE SPACE.
3. WHEN GIVEN A GROUP OF TREES AND SHRUBS, SELECT THOSE THAT BEST MEET THE REQUIREMENTS FOR THEIR INTENDED FUNCTION.

### B. INSTRUCTIONAL AREAS

#### 1. IDENTIFYING TREES AND SHRUBS

##### A. IDENTIFYING DECIDUOUS TREES

- (1) DETERMINING LEAF ARRANGEMENT
- (2) DETERMINING LEAF COMPOSITION
- (3) DETERMINING LEAF MARGIN CHARACTERISTICS
- (4) USING BUDS AND BUD SCARS AS INDICATORS FOR IDENTIFICATION
- (5) USING COLOR SIZE AND SHAPE FOR IDENTIFICATION

##### B. IDENTIFYING EVERGREENS



- (1) DETERMINING NEEDLE SIZE
- (2) DETERMINING NEEDLE ARRANGEMENT
- (3) USING COLOR AS AN IDENTIFICATION INDICATOR

C. IDENTIFYING BROADLEAF EVERGREENS

- (1) RECOGNIZING TWIG CHARACTERISTICS
- (2) RECOGNIZING LEAF CHARACTERISTICS

2. SELECTING ACCORDING TO TREE AND SHRUB REQUIREMENTS

- A. DETERMINING ADAPTABILITY TO ENVIRONMENTAL CONDITIONS
- B. DETERMINING HARDINESS CAPABILITIES
- C. DETERMINING NUTRITIONAL NEEDS
- D. DETERMINING DISEASE AND INSECT RESISTANCE
- E. DETERMINING MAINTENANCE REQUIREMENTS

3. SELECTING ACCORDING TO FUNCTION

- A. DETERMINING SHAPE OF TREES
- B. DETERMINING GROWTH CHARACTERISTICS
- C. DETERMINING TEXTURE OF ESTABLISHED TREES AND SHRUBS
- D. ESTIMATING COST OF DESIRABLE TREES AND SHRUBS

C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. HAVE STUDENTS USE PLANT AND SHRUB KEYS TO IDENTIFY VARIOUS TREES AND SHRUBS ON AND AROUND THE SCHOOL GROUNDS.  
  
B. HAVE STUDENTS BRING IN VARIOUS TWIGS, LEAVES, ETC., TO IDENTIFY BY USING PLANT KEYS. THIS COULD ALSO SERVE AS A "CONTEST" TO FIND OUT WHICH STUDENT COULD BRING IN THE MOST SPECIMENS AND IDENTIFY THEM.
2. USING LANDSCAPE PLANS, HAVE STUDENTS MAKE UP A RECOMMENDED LIST OF TREES AND SHRUBS THAT WILL MEET THE NEEDS OF THESE PLANS.
3. TAKE A WALKING FIELD TRIP FOR THE PURPOSE OF TREE IDENTIFICATION WITHOUT THE USE OF HELP. THIS WILL SERVE AS AN ALTERNATIVE FOR CLASSROOM STUDY AS WELL AS PROVIDE AN EDUCATIONAL OBJECTIVE.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. SET UP A MATCHING EXERCISE USING PICTURES, SLIDES OR OTHER VISUAL AIDES AND HAVE STUDENTS MATCH THE "VISUALS" WITH A LIST OF TREES AND SHRUBS OF THE LOCAL AREA WITHOUT THE USE OF REFERENCES. STUDENTS SHOULD HAVE MASTERY OF IDENTIFICATION OF AT LEAST FIFTY TREES AND FIFTY SHRUBS FOR BASIC COMPETENCE WITHOUT THE USE OF AN IDENTIFICATION KEY.
2. EACH STUDENT MUST INDICATE ORALLY OR IN WRITING WHICH SHRUBS OR TREES WOULD BE MOST APPROPRIATE TO USE FOR A GIVEN LANDSCAPE PLANT WHICH CALLS FOR PLANTS BY PHYSICAL SIZE AND SHAPE. STUDENTS MUST HAVE A KNOWLEDGE OF THESE CHARACTERISTICS OF TREES AND SHRUBS IN ORDER TO CORRECTLY COMPLETE THIS EXERCISE.
3. WITH A LIST OF TREES AND SHRUBS CLASSIFIED BY SHAPE, GROWTH CHARACTERISTICS, AND TEXTURE EACH STUDENT MUST INDICATE IN WRITING OR ORALLY THE BEST USE OF EACH (FUNCTION) WITH COMPLETE ACCURACY.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. LANDSCAPE PLANS (THESE CAN BE VERY SIMPLE OR MORE DETAILED, DEPENDING UPON SOURCE.) REFERENCES CITED GIVE SOME EXCELLENT EXAMPLES.
2. PLANT KEYS FOR COMMON TREES AND LANDSCAPE SHRUBS.
3. TWIGGS, LEAVES AND PLANTS FOR IDENTIFICATION. PICTURES, DRAWINGS, SLIDES, OR OTHER SIMILAR AIDS CAN ALSO BE USED.

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. SHRUBS FOR LANDSCAPING. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1972.

A PUBLICATION WHICH DEALS WITH SHRUB IDENTIFICATION AS WELL AS SOME ADDITIONAL INFORMATION ON SHRUB SELECTION, AND SOIL PREPARATION AND PLANTING OF SHRUBS.

2. TREES FOR LANDSCAPING. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1972.

THIS IS AN EXCELLENT REFERENCE SOURCE FOR TREE IDENTIFICATION WHICH INCLUDES A DISCUSSION OF HOW TREES ARE NAMED, INDICATORS FOR IDENTIFYING TREES, THE USE OF A SIMPLIFIED PLANT KEY AS WELL AS SOME CONSIDERATIONS FOR TREE CULTURE.

## PLANTING TREES AND SHRUBS

**UNIT CONCEPT:** PROPER PLANTING OF TREES AND SHRUBS BY THE TREE SERVICE WORKER PROVIDES PLANTS THAT WILL GROW AND DEVELOP AS THEY WERE INTENDED.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A LANDSCAPE PLAN AND VARIOUS TYPES OF TREES AND SHRUBS WHICH ARE BARERoot, BALLED AND BURLAPPED, TRANSPLANT EACH USING THE RECOMMENDED PROCEDURE AND PRACTICES.
2. WHEN GIVEN TREES NEEDING PROTECTION FROM WINTER WINDS AND TEMPERATURES, PROPERLY WRAP AND STAKE THE TREES ACCORDING TO INDUSTRY STANDARDS.
3. WHEN GIVEN NEWLY PLANTED TREES AND SHRUBS, DEMONSTRATE THE RECOMMENDED METHOD OF WATERING TO THE SATISFACTION OF THE INSTRUCTOR.
4. WHEN GIVEN AN ORGANIC MULCH MATERIAL AND SUFFICIENT HAND TOOLS, APPLY A MULCH TO THE TREES AND SHRUBS TO CONSERVE MOISTURE, MAINTAIN AN EVEN SOIL TEMPERATURE, AND ADD TO THE BEAUTY OF THE SURROUNDINGS.

### B. INSTRUCTIONAL AREAS

1. TRANSPLANTING TREES
  - A. DETERMINING TIME FOR TRANSPLANTING
  - B. PREPARING THE HOLE FOR TRANSPLANTING
    - (1) DETERMINING PROPER DEPTH
    - (2) DETERMINING PROPER WIDTH
  - C. PRUNING ROOTS OF BARERoot PLANTS
  - D. REMOVING OR LOOSENING BURLAP
  - E. SETTING THE TREE IN HOLE

- F. REPACKING THE SOIL
- G. FERTILIZING AND WATERING
- H. PRUNING THE NEWLY PLANTED TREE
- 2. WRAPPING AND STAKING TREES
  - A. IDENTIFYING TREES REQUIRING WRAPPING
  - B. SELECTING WRAPPING MATERIAL
  - C. WRAPPING THE TREE
  - D. SELECTING THE METHOD OF SUPPORTING THE TREE
  - E. STAKING THE TREE FOR SUPPORT
- 3. TRANSPLANTING SHRUBS
  - A. CARING FOR BARERoot, BALLED AND BURLAPPED, AND CONTAINER GROWN STOCK
  - B. DETERMINING TIME FOR TRANSPLANTING
  - C. DETERMINING PROPER SPACING
  - D. PREPARING HOLE FOR TRANSPLANTING
  - E. REPACKING SOIL AROUND SHRUB
  - F. FERTILIZING AND WATERING
  - G. PRUNING
  - H. PROTECTING SHRUBS FROM WATER LOSS
- 4. MULCHING TREES AND SHRUBS
  - A. DETERMINING PURPOSE OF MULCHING
  - B. SELECTING THE PROPER MULCH
  - C. APPLYING MULCHES
    - (1) DETERMINING TIME TO APPLY
    - (2) DETERMINING DEPTH OF MULCH NEEDED

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. HAVE STUDENTS TRANSPLANT VARIOUS TYPES OF PLANTS WHICH ARE BAREROOT, BALLED AND BURLAPPED, AND CONTAINER GROWN STOCK. THIS COULD BE DONE TO BEAUTIFY THE SCHOOL GROUNDS AS A PROJECT OF THE FFA CHAPTER OR IN COOPERATION WITH OTHER SCHOOL OR COMMUNITY GROUPS.
2. A. HAVE STUDENTS MAKE CHARTS, OR TRANSPARENCIES OF THE PROPER PLANTING, STAKING, AND WRAPPING OPERATIONS FOR USE IN CLASS AND FOR GIVING DEMONSTRATIONS TO OTHER CLASSES OR GROUPS.  
  
B. HAVE STUDENTS WRAP, AND STAKE, NEWLY PLANTED TREES AND SHRUBS.
3. HAVE STUDENTS PRACTICE PROPER PROCEDURES FOR WATERING TRANSPLANTED TREES AND SHRUBS.
4. IDENTIFY USES OF DIFFERENT TYPES OF MULCHES FOR LANDSCAPING; APPLY A NUMBER OF THE DIFFERENT MULCHES AND HAVE STUDENT CONSIDER EACH FOR DESIRABILITY, BEAUTY, AND EFFECTIVENESS.

### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. HAVE EACH STUDENT LIST THE PROCEDURES TO FOLLOW FOR PROPERLY TRANSPLANTING BALLED AND BURLAPPED TREES AND SHRUBS. THE LISTING MUST INCLUDE TIME OF PLANTING, PROCEDURE FOR SETTING TREE IN PREPARED HOLE, PACKING THE SOIL, FERTILIZING AND WATERING, PRUNING, WRAPPING AND STAKING.
2. GIVE STUDENTS DRAWINGS OR PICTURES OF WRAPPED AND STAKED TREES, SOME OF WHICH ARE PROPERLY DONE AND OTHERS THAT ARE NOT, AND HAVE STUDENTS INDICATE THOSE WHICH ARE DONE SATISFACTORILY. FOR THOSE THAT ARE NOT, STUDENTS MUST DESCRIBE CORRECTIVE PROCEDURES IN ORDER FOR THEM TO MEET INDUSTRY STANDARDS.
3. USING PICTURES OF RECENTLY WATERED TREES OR SHRUBS, HAVE STUDENTS INDICATE THOSE THAT HAVE NOT RECEIVED SUFFICIENT WATER, THOSE THAT ARE PROPERLY WATERED, AND THOSE THAT ARE "OVER WATERED" WITH COMPLETE ACCURACY.
4. THE STUDENT SHOULD LIST THE FACTORS TO CONSIDER WHEN SELECTING MATERIALS FOR MULCHING PURPOSES. THIS LIST MUST INCLUDE THE FOLLOWING: (1) AVAILABILITY, (2) COST COMPARISONS, (3) APPEARANCE, (4) DURABILITY, (5) RATE OF DECOMPOSITION, (6) POSSIBILITY OF PRODUCING WEED SEED, (7) DANGER OF INTRODUCING DISEASES, (8) POSSIBILITY OF FIRE.



## E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. SEVERAL TREES AND SHRUBS READY FOR TRANSPLANTING
2. STRAW, SAWDUST, PEAT AND WOOD CHIPS TO USE AS MULCHES
3. STAKES, WRAPPING, STRING, HOSE AND WIRE FOR GUYING TREES
4. SHOVELS FOR PLANTING SPECIMENS.

## F. EXAMPLES OF SUPPORTING REFERENCES

1. LANDSCAPE MAINTENANCE AND ESTABLISHMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 24 AND 47-56.

THIS IS ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE WHICH IS DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THEIR RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH COVER THE OBJECTIVES OF THIS UNIT.

2. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 207-216 AND 231-234.

PART II OF A TWO VOLUME SET OF REFERENCE MATERIALS FOR A NURSERY WORKER COURSE OF STUDY. MATERIAL COVERED IN PART II DEALS WITH NURSERY PRACTICES INCLUDING METHODS OF PLANT PROPAGATION, FIELD PRACTICES, PEST CONTROL, MARKETING AND RECORD KEEPING. THE SECTION ON TRANSPLANTING, STAKING AND PRUNING IS ESPECIALLY USEFUL FOR ACCOMPLISHING THE OBJECTIVES OF THIS UNIT.

## APPLICATION OF FERTILIZER TO TREES

**UNIT CONCEPT:** EXISTING NATURAL LEVELS OF PLANT NUTRIENTS ARE NOT USUALLY ADEQUATE OR BALANCED WELL ENOUGH FOR BEST GROWTH OF TREES. SOIL TESTING AND ANALYSIS WILL HELP THE ARBORICULTURALIST ACHIEVE A PROPER BALANCE OF NUTRIENTS FOR VARIOUS TYPE OF TREES.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A SITE WITH ESTABLISHED TREES, DEMONSTRATE THE PROPER METHOD OF TAKING A REPRESENTATIVE SOIL SAMPLE AND DETERMINE THE NEED FOR FERTILIZATION BY INTERPRETING THE RESULTS OF THE SOIL TEST.
2. WHEN GIVEN SEVERAL FIXED ANALYSIS FERTILIZERS, DETERMINE THE POUNDS OF ACTUAL PLANT FOOD IN EACH WITHIN  $\pm$  ONE POUND.
3. WHEN GIVEN TREES EXHIBITING UNDERSIZED OR YELLOW LEAVES, SPARCE FOLIAGE, OR LITTLE TWIG OR BRANCH GROWTH, DETERMINE THE FERTILITY NEEDS OF THE PLANTS.
4. WHEN GIVEN LIQUID AND GRANULAR FERTILIZER APPLICATORS, CALIBRATE AND APPLY THE NEEDED MATERIALS TO THE LANDSCAPE PLANTS AND PREPARE THE EQUIPMENT FOR STORAGE FOLLOWING USE.

### B. INSTRUCTIONAL AREAS

1. TAKING A SOIL SAMPLE
  - A. SELECTING AND ACQUIRING EQUIPMENT NEEDED
  - B. PROCEDURES FOR GETTING A REPRESENTATIVE SAMPLE
  - C. DETERMINING TIME OF YEAR FOR SAMPLING
  - D. PREPARING THE SAMPLE FOR LABORATORY ANALYSIS
  - E. FILLING IN FORMS FOR SENDING SAMPLES TO TESTING LABORATORIES

## 2. INTERPRETING SOIL TEST RESULTS

- A. DETERMINING AMOUNT OF APPLICATION NEEDED
- B. DETERMINING RECOMMENDED ANALYSIS NEEDED FOR IMPROVEMENT
- C. DETERMINING TIME OF YEAR FOR APPLICATION

## 3. SELECTING AND PURCHASING FERTILIZER AND LIME

- A. DETERMINING NUTRIENT NEEDS OF TREES
- B. RECOGNIZING AND SELECTING RECOMMENDED FERTILIZER ACCORDING TO FORM AND CHARACTERISTICS
- C. DETERMINING FERTILIZER RATIOS
- D. SELECTING FOR NUTRIENT AVAILABILITY
- E. PURCHASING ECONOMICS OF FERTILIZERS

## 4. APPLYING FERTILIZERS AND LIMES TO TREE AREAS

- A. METHODS OF APPLICATION AND EFFECTIVENESS
- B. IDENTIFYING VARIOUS TYPES OF SPREADERS AND APPLICATORS
- C. CALIBRATING SPREADERS AND APPLICATORS
- D. APPLICATION PROCEDURES FOR EFFECTIVENESS
- E. CLEANING PROCEDURES AND LUBRICATION

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. HAVE STUDENTS SAMPLE SOIL AROUND ESTABLISHED TREES, AND SEND TO AN ESTABLISHED LABORATORY FOR ANALYSIS. STUDENTS CAN THEN REVIEW AND INTERPRET RECOMMENDATIONS AFTER RESULTS ARE RETURNED.
- B. VISIT A SOIL TESTING LAB IF ONE IS NEARBY, AND HAVE STUDENTS OBSERVE AND SUMMARIZE THE PROCEDURE USED TO ANALYZE SOIL SAMPLES IN A CLASS REPORT.
- C. HAVE STUDENTS SAMPLE HOME OWNERS SOIL AROUND TREES AND SEND THEM TO THE LAB FOR TESTING. THIS IS A GOOD PUBLIC RELATIONS TOOL FOR THE SCHOOL. OF COURSE THE HOME OWNER MUST BEAR THE COST OF MAILING AND TESTING.

2. A. WITH SEVERAL FERTILIZER BAGS, HAVE THE STUDENTS STUDY INFORMATION ON THE BAG. THEY SHOULD STUDY SUCH ITEMS AS ANALYSIS, POUNDS OF NUTRIENTS, CONTENTS AND INFORMATION ON PROPER APPLICATION AND BE ABLE TO DESCRIBE WHAT THE INFORMATION MEANS.  
  
B. IF POSSIBLE, VISIT A FERTILIZER PLANT AND ASSIGN GROUPS OF STUDENTS TO PREPARE CLASS PRESENTATIONS ON THE VARIOUS STEPS OF THE PROCESS.
3. HAVE STUDENTS DEVELOP A SET OF SLIDES SHOWING TREES WITH VARIOUS NUTRIENT DEFICIENCIES AND THEN HAVE STUDENTS DESCRIBE WHAT TYPE OF FERTILIZER(S) IS NEEDED TO CORRECT THESE DEFICIENCIES.
4. STUDENTS SHOULD CALIBRATE VARIOUS TYPES OF SPREADERS FOR VARIOUS RATES OF APPLICATION.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. GIVE STUDENTS "EXAMPLE" TREES WHICH SHOW NUTRIENT DEFICIENCIES AND HAVE STUDENTS LIST THE STEPS ONE MUST FOLLOW TO DETERMINE WHAT LEVEL OF FERTILIZATION IS NEEDED TO CORRECT THE DEFICIENCY. THIS LIST SHOULD INCLUDE SOIL SAMPLING, SENDING TO LABORATORY FOR ANALYSIS, INTERPRETING ANALYSIS INFORMATION, AND SELECTING FERTILIZER(S) NEEDED.
2. USING FERTILIZER BAG LABELS, HAVE STUDENTS FIGURE THE POUNDS OF ACTUAL PLANT FOOD IN EACH WITHIN  $\pm$  ONE POUND.
3. USE SLIDES, PICTURES, OR LEAF SAMPLES SHOWING NUTRIENT DEFICIENCIES AND HAVE STUDENTS MATCH EACH OF THESE TO A LIST OF NUTRIENTS (FERTILIZERS) WHICH WILL CORRECT THE DEFICIENCIES WITH 95% ACCURACY.
4. EACH STUDENT SHOULD LIST OR EXPLAIN THE PROCEDURES FOR CALIBRATING A FERTILIZER APPLICATOR WITH COMPLETE ACCURACY. IF POSSIBLE, THIS SHOULD BE CARRIED TO THE "FIELD" AND DEMONSTRATED WITH ACTUAL TREES.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. FERTILIZERS OF VARYING ANALYSES INCLUDING MICRONUTRIENTS
2. LIQUID APPLICATORS
3. FERTILIZER BAGS FOR LABEL INFORMATION ANALYSIS ACTIVITY

4. SOIL TESTING MAILING KITS (THESE CAN BE ACQUIRED IN A COUNTY EXTENSION OFFICE IN YOUR AREA)
5. SOIL AUGER

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. LANDSCAPE MAINTENANCE AND ESTABLISHMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 12-17.

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## PRUNING TREES, SHRUBS AND HEDGES

**UNIT CONCEPT:** BECAUSE TREES, SHRUBS AND HEDGES REQUIRE PRUNING TO REMOVE DEAD OR INJURED PARTS TO STIMULATE GROWTH AND/OR TO MAINTAIN A FORMAL SHAPE, IT IS NECESSARY THAT THE TREE SERVICE WORKER BE ABLE TO SELECT AND REMOVE UNNECESSARY BRANCHES.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN AN INJURED TREE OR SHRUB, DEMONSTRATE THE PROCEDURE FOR REMOVING AND/OR REPAIRING THE INJURY TO THE SATISFACTION OF THE TEACHER OR INDUSTRY STANDARDS.
2. WHEN GIVEN A SHRUB IN NEED OF REJUVENATION, REMOVE THE NECESSARY WOOD TO RESTORE THE SHRUB'S YOUTHFUL APPEARANCE ACCORDING TO INDUSTRY RECOMMENDATIONS.
3. WHEN GIVEN AN ODD SHAPE SHRUB, RECOMMEND CORRECTIVE PRUNING PROCEDURES TO DEVELOP A MORE BALANCED AND COMPACT APPEARANCE TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER.
4. WHEN GIVEN A FORMAL HEDGE AND THE INTENDED CONFORMATION, SHEAR IT TO MAINTAIN A THICK AND COMPACT GROWTH WHICH WILL MATCH THE DESIRED CONFORMATION.

### B. INSTRUCTIONAL AREAS

1. REPAIRING INJURED PLANTS
  - A. UNDERSTANDING THE IMPORTANCE OF PRUNING
  - B. DETERMINING TYPE OF INJURY
  - C. SELECTING PRUNING EQUIPMENT
  - D. REMOVING BROKEN BRANCHES
  - E. REMOVING DEAD BRANCHES
  - F. REMOVING AND TREATING TORN BARK

**2. REJUVENATING OLD SHRUBS**

- A. DETERMINING AMOUNT OF PRUNING NEEDED
- B. DETERMINING TIME FOR PRUNING
- C. SELECTING EQUIPMENT TO USE
- D. PRUNING PROCEDURES AND TREATMENT

**3. DEVELOPING FORM IN SHRUBBERY**

- A. DETERMINING TYPE OF FORM DESIRED
- B. DETERMINING TYPE OF EQUIPMENT TO USE
- C. DETERMINING TIME FOR PRUNING AND TRIMMING

**4. MAINTAINING FORMAL HEDGES**

- A. DETERMINING SHAPE OF HEDGE
- B. DETERMINING TIME OF TRIMMING
- C. SELECTING EQUIPMENT TO USE

**5. PRUNING MATURE TREES**

- A. DETERMINING TIME FOR PRUNING
- B. DETERMINING LIMBS AND BRANCHES THAT NEED TO BE REMOVED
- C. SELECTING NEEDED EQUIPMENT
- D. UNDERCUTTING PROCEDURES
- E. FINAL CUTTING PROCEDURES
- F. APPLYING WOUND DRESSING TO TREE WOUNDS

**C. EXAMPLES OF STUDENT LEARNING ACTIVITIES**

- 1. HAVE STUDENTS PRACTICE VARIOUS PRUNING TECHNIQUES AND PROCEDURES ON A VARIETY OF TREES AND SHRUBS WITH BROKEN BRANCHES AND OTHER COMMON INJURIES.
- 2. HAVE STUDENTS STUDY PICTURES OR ACTUAL TREES AND SHRUBS AND DETERMINE WHICH ONES NEED PRUNING FOR REJUVENATION THEN OUTLINE THE STEPS OR PROCEDURES FOR ACCOMPLISHING THIS REJUVENATION.



3. LOCATE TREES AND SHRUBS WHICH CAN BE USED TO DEVELOP PRUNING SKILLS IN REMOVING INJURED LIMBS, REPAIRING DAMAGED BARK, AND CORRECTING FOR ODD SHAPE. THEN HAVE STUDENTS CORRECT THESE DEFICIENCIES BY USING RECOMMENDED PROCEDURES.
4. HAVE STUDENTS BUILD A WOODEN FRAME TO USE AS A GUIDE FOR SHEARING A FORMAL HEDGE TO MAINTAIN A THICK AND COMPACT GROWTH.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING DRAWINGS OF TREES OR SHRUBS WITH DEAD OR BROKEN BRANCHES OR INJURED LIMBS, HAVE STUDENT DESCRIBE ORALLY OR DEMONSTRATE WHICH BRANCHES OR LIMBS SHOULD BE REMOVED AND WHERE CUTS SHOULD BE MADE WITH COMPLETE ACCURACY.
2. EACH STUDENT SHOULD DESCRIBE IN WRITING OR ORALLY THE PROCEDURE FOR REJUVENATING SHRUBS, BOTH DECIDUOUS AND EVERGREEN, AND MUST INCLUDE IN THEIR RESPONSE FOR DECIDUOUS SHRUBS: (1) CUTTING ALL WOOD TO GROUND LEVEL IN EARLY SPRING, (2) MULCHING, AND (3) TRIMMING SPROUTS IN FIRST SEASON. FOR EVERGREEN SHRUBS, THEY MUST INCLUDE: (1) REMOVING LONG BRANCHES IN APRIL, AND (2) MULCHING.
3. USING PICTURES OF SHRUBS WITH ODD SHAPES, HAVE STUDENTS DESCRIBE ORALLY OR IN WRITING THE PROCEDURE(S) WHICH NEED TO BE CARRIED OUT IN ORDER TO DEVELOP A MORE BALANCED AND COMPACT SHRUB. THIS DESCRIPTION SHOULD INCLUDE WHERE CUTS SHOULD BE MADE AND EQUIPMENT NEEDED TO ACCOMPLISH THE TASK.
4. EACH STUDENT SHOULD LIST THE "POINTS TO REMEMBER" IN TRIMMING AND MAINTAINING FORMAL HEDGES. THIS LIST SHOULD INCLUDE: (1) TIME OF YEAR FOR VARIOUS TYPES OF HEDGES, (2) BASE SHOULD BE WIDER THAN THE TOP, AND (3) AVOID DEEP CUTS INTO WOOD.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. LADDERS
2. PRUNING SHEARS
3. SHEARS OR HEDGE CLIPPERS
4. LOPPING SHEARS, HAND SAW, OR POWER SAW
5. TREE WOUND DRESSING (OR SUITABLE LEAD PAINT)

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. FIFTY LABORATORY EXERCISES FOR VOCATIONAL HORTICULTURE STUDENTS. DANVILLE, ILLINOIS: THE INTERSTATE PRINTERS AND PUBLISHERS, INC. PP. 47-52.

A PUBLICATION WHICH CONTAINS LABORATORY EXERCISES (PURPOSE, PROCEDURES, EQUIPMENT, ETC.) WHICH ASSIST IN DEVELOPING THE COMPETENCIES COVERED IN THIS UNIT.

2. LANDSCAPE MAINTENANCE AND ESTABLISHMENT. UNIVERSITY PARK, PENNSYLVANIA: AGRICULTURAL EDUCATION DEPARTMENT, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 12-17.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THEIR RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT.

3. ORNAMENTAL HORTICULTURE SOURCE UNITS FOR VOCATIONAL TEACHERS. DANVILLE, ILLINOIS: THE INTERSTATE PRINTERS AND PUBLISHERS, INC. PP. 79-93.

A PUBLICATION DIVIDED INTO SEVEN HORTICULTURAL AREAS (TURF, PLANT PROPAGATION, GREENHOUSE MANAGEMENT, ARBORICULTURE, NURSERY MANAGEMENT, LANDSCAPING, AND FLOWERS AND FLORAL ARRANGEMENTS) WHICH CONTAIN PROBLEM AREA OUTLINES, TEACHING AIDS, LABORATORY EXERCISES AND STUDY QUESTIONS AND ANSWERS FOR EACH OF THE FIVE AREAS.

## TREE MAINTENANCE PROCEDURES

**UNIT CONCEPT:** TREES REQUIRE PROPER MAINTENANCE AND CARE IF THEY ARE TO REMAIN ATTRACTIVE AND HEALTHY. THEREFORE, THE TREE SERVICE WORKER MUST BE ABLE TO PERFORM THOSE SKILLS NECESSARY FOR MAINTAINING TREES IN ORDER THAT THE CUSTOMER WILL BE SATISFIED WITH THE COMPLETED JOB.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A TREE DAMAGED BY INSECTS AND/OR DISEASES, DEMONSTRATE THE ABILITY TO CARRY OUT THE RECOMMENDED CONTROL MEASURES SAFELY AND CLEAN AND STORE EQUIPMENT USED ACCORDING TO RECOMMENDED PROCEDURES.
2. WHEN GIVEN ROPE AND A WORK ORDER WHICH REQUIRES ROPE TO BE USED, DEMONSTRATE THE ABILITY TO TIE THE FOLLOWING KNOTS AND SPLICES WITHOUT THE USE OF REFERENCES:
  - A. BOWLINE
  - B. BOWLINE ON A BITE
  - C. CLOVE HITCH
  - D. SQUARE KNOT
  - E. SHEET BEND
  - F. TIMBER HITCH
  - G. HALF HITCH
  - H. TAUTLINE
  - I. BLOCK
3. WHEN GIVEN A TREE WITH A SPLIT FORK OR CROTCH, DEMONSTRATE THE ABILITY TO CLIMB THE TREE AND SECURE NECESSARY CABLES AND FASTENERS ACCORDING TO INDUSTRY STANDARDS.
4. WHEN GIVEN A TREE IN NEED OF TRIMMING OR REMOVAL, DEMONSTRATE THE ABILITY TO CLIMB THE TREE, REMOVE LIMBS, AND/OR CUT THE TRUNK, AND GRIND THE STUMP ACCORDING TO RECOMMENDED SAFE PROCEDURES.

## B. INSTRUCTIONAL AREAS

### 1. SPRAYING TREES FOR INSECTS AND DISEASES

- A. IDENTIFYING DAMAGED TREES AND SOURCE OF DAMAGE
- B. DETERMINING RECOMMENDED CONTROL MEASURES TO USE AND TIME OF APPLICATION
- C. SELECTING EQUIPMENT
- D. FOLLOWING RECOMMENDED APPLICATION PROCEDURES AND SAFETY PRECAUTIONS
- E. CLEANING EQUIPMENT AFTER USE
- F. STORING CHEMICALS AFTER USE

### 2. USING ROPE IN TREE MAINTENANCE WORK

- A. IMPORTANCE OF TYING AND SPLICING ROPE
- B. DETERMINING TYPE OF KNOT NEEDED FOR JOB
- C. SPLICING PROCEDURES AND PURPOSES
- D. TYING COMMONLY USED KNOTS
  - (1) BOWLINE
  - (2) BOWLINE ON A BITE
  - (3) CLOVE HITCH
  - (4) SQUARE KNOT
  - (5) SHEET BEND
  - (6) TIMBER HITCH
  - (7) HALF HITCH
  - (8) TAUTLINE HITCH
  - (9) BLOCK
- E. WRAPPING ROPE FOR STORAGE
- F. TYING THE BUTT HITCH FOR USE AS ANCHORING DEVICE

### 3. CLIMBING TECHNIQUES AND PROCEDURES

- A. SELECTING EQUIPMENT FOR CLIMBING
- B. SECURING SAFETY LINES AND LIFELINES
- C. TYING THE THROWING KNOT
- D. PROCEDURE FOR ASCENDING TREES SAFELY
- E. PROCEDURE FOR DESCENDING TREES SAFELY
- F. PHYSICAL CONDITIONING FOR CLIMBING
- G. DETERMINING INSURANCE NEEDS FOR CLIMBING

#### 4. CABLING TREES

- A. DETERMINING TYPE OF EQUIPMENT AND HARDWARE NEEDED
- B. SECURING EYE BOLTS OR LAG SCREWS INTO LIMBS
- C. SECURING CABLE TO EYE BOLTS
- D. PULLING TREE FORKS TOGETHER WITH CABLE BY GROUND CREW
- E. APPLYING WOUND DRESSING TO AREAS INJURED BY CABLING
- F. TOPPING THE TREE TO REDUCE WEIGHT AND STRAIN ON WEAK FORKS

#### 5. REPAIRING DAMAGED TREES (TREE SURGERY)

- A. DETERMINING TYPE OF DAMAGE AND LOCATION
- B. REPAIRING BARK DAMAGE
  - (1) TRIMMING EDGES OF BARK BACK TO GREEN WOOD
  - (2) SELECTING WOUND DRESSING
  - (3) APPLYING WOUND DRESSING TO DAMAGED AREA
- C. FILLING CAVITIES IN TREES
  - (1) DETERMINING EXTENT OF DAMAGE AND SIZE OF CAVITY
  - (2) SELECTING TYPE OF FILLER MATERIAL TO USE
  - (3) SELECTING EQUIPMENT NEEDED
  - (4) PROCEDURE FOR FILLING CAVITY WITH CONCRETE OR PREPARED FILLER MATERIAL AND WIRE MESH
- D. TRIMMING AND REMOVING TREES
  - (1) DETERMINING LIMBS AND BRANCHES TO BE REMOVED
  - (2) SELECTING NEEDED ROPES AND EQUIPMENT
  - (3) CLIMBING DECISIONS AND ASCENDING THE TREE
  - (4) DETERMINING WHERE LIMBS AND BRANCHES WILL FALL AND NECESSARY SAFETY PRECAUTIONS
  - (5) CUTTING AND TRIMMING PROCEDURES
  - (6) TREATING WOUNDS CAUSED BY TRIMMING
  - (7) GRINDING THE STUMP
  - (8) CLEANING UP THE AREA AFTER WORK IS COMPLETED

#### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. USING SLIDES, PICTURES, OR OTHER VISUAL AIDS, OF INSECT AND DISEASED DAMAGED TREES, HAVE STUDENTS USE REFERENCES AND DETERMINE CONTROL MEASURES TO EFFECTIVELY CONTROL PROBLEM.

2. HAVE EACH STUDENT SPLICE ROPES AND TIE ALL KNOTS COVERED UNDER INSTRUCTIONAL AREAS, AND FOR INTEREST IN PRACTICING, HAVE CONTEST TO INCREASE SPEED AND EFFICIENCY.
3. GIVE STUDENTS DRAWINGS OF TREES IN NEED OF TRIMMING OR REMOVAL AND HAVE GROUPS TO OUTLINE THE PROCEDURE(S) TO BE USED IN COMPLETING THE ASSIGNED TASK. THIS LISTING SHOULD INCLUDE SUCH THINGS AS EQUIPMENT TO BE USED, TYPES OF KNOTS TO BE USED, ROPE POSITIONS DURING WORK AND WOUND TREATMENT NEEDED.
4. A. HAVE STUDENTS SURVEY CAMPUS AREA TO DETERMINE TREES IN NEED OF REPAIR BY TRIMMING, THOSE TREES THAT SHOULD BE REMOVED, AND DAMAGED TREES THAT NEED WOUNDS TREATED, AND THEN ASSIGN GROUPS OR INDIVIDUALS TO CARRY OUT RECOMMENDED TREATMENT, REMOVAL, OR TRIMMING PROCEDURES.  
  
B. IF POSSIBLE, SPEND A DAY WITH A COMMERCIAL TREE SERVICE CREW AND HAVE STUDENTS OBSERVE OPERATIONS AND THEN WRITE CRITIQUES OF OPERATION NOTING ANY IMPROPER PROCEDURES, OR TECHNIQUES USED. THIS SHOULD ALSO INCLUDE SAFETY PROCEDURES.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. DEVELOP A MATCHING TEST USING PICTURES OR SLIDES OF TREES DAMAGED BY INSECTS AND/OR DISEASES AND HAVE STUDENTS MATCH WITH A LIST OF CONTROL MEASURES WITH COMPLETE ACCURACY. DISEASE AND INSECT DAMAGE COMMON TO THE LOCAL AREA SHOULD BE MATCHED WITHOUT THE USE OF REFERENCES.
2. EACH STUDENT SPLICE AND TIE THE NINE KNOTS COVERED UNDER INSTRUCTIONAL AREAS ACCORDING TO RECOMMENDED PROCEDURES AND DONE TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER IF PLACED IN A TREE SERVICE BUSINESS.
3. STUDENTS SHOULD DESCRIBE ORALLY OR IN WRITING, FACTORS TO CONSIDER WHEN CLIMBING TREES AND SECURING FASTENERS AND CABLES ACCORDING TO INDUSTRY STANDARDS. THIS DESCRIPTION SHOULD INCLUDE: (1) SURVEYING TREE LAYOUT, (2) SECURING LIFELINES FOR SAFETY, (3) "TESTING" BRANCHES AND LIMBS BEFORE CLIMBING, (4) ACQUIRING NECESSARY SAFETY EQUIPMENT SUCH AS HARD HAT AND SAFETY BELT, AND (5) TYPE OF LOG BOLTS OR FASTENERS NEEDED. (HAVING THE STUDENT TO ACTUALLY DEMONSTRATE CLIMBING TECHNIQUES IS MOST DESIRABLE TEST OF COMPETENCE.)

4. EACH STUDENT SHOULD OUTLINE THE STEPS NECESSARY TO REMOVE OR TRIM TREES AND TO REMOVE STUMPS BY GRINDING. THIS LIST SHOULD INCLUDE: (1) DETERMINING LIMBS TO BE REMOVED, (2) EQUIPMENT NEEDED FOR JOB, (3) CLIMBING NECESSARY, (4) LOCATION OF CUTS, AND (5) SAFETY PRECAUTIONS TO BE FOLLOWED.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. SUFFICIENT ROPE FOR TYING VARIOUS KNOTS STUDIES
2. SPRAY EQUIPMENT STUDIES
3. CABLE, EYE BOLTS, LAG BOLTS FOR CABLING TREES
4. WOUND DRESSINGS, FILLER MATERIAL FOR FILLING CAVITIES AND/OR CONCRETE
5. CUTTING TOOLS, (POWER SAWS, HAND SAWS, AND CHAIN SAWS)
6. DRAWINGS, CHARTS, SLIDES SHOWING PROCEDURE FOR TYING KNOTS
7. CHEMICALS COMMONLY USED FOR CONTROLLING TREE DISEASES AND INSECTS
8. SLIDES, OR OTHER VISUAL AIDS FOR SHOWING DAMAGED TREES, AND INSECT AND DISEASE DAMAGED TREES.

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. LANDSCAPE MAINTENANCE AND ESTABLISHMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 12-15.

THIS IS ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE WHICH ARE DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THEIR RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT.

2. PIRONE, PASCAL P. DISEASES AND PESTS OF ORNAMENTAL PLANTS, THIRD EDITION. NEW YORK, NEW YORK: RONALD PRESS. 1960, 546 PAGES.

A COMPREHENSIVE PUBLICATION DEALING WITH SYMPTOMS, AND CONTROL PROCEDURES FOR TREE DISEASES AS WELL AS MANY OTHER ORNAMENTAL PLANTS.



3. A TWO-YEAR PROGRAM IN VOCATIONAL HORTICULTURE, SECTION ONE. ST. PAUL, MINNESOTA: AGRICULTURAL EDUCATION DEPARTMENT, STATE DEPARTMENT OF VOCATIONAL EDUCATION. PP. 186-247.

THIS TWO PART MIMEOGRAPHED REFERENCE CONTAINS TEACHER DEVELOPED MATERIALS WHICH COVER MANY OF THE TOPICS COVERED IN THIS UNIT.

## III

## FLORICULTURE

U.S.O.E. CODE 01.05 02 00 00

PLANTING MEDIA PREPARATION

GREENHOUSE PLANT PROPAGATION

FERTILIZATION OF FLORAL PLANTS

MAINTAINING DESIRABLE ENVIRONMENTAL CONDITIONS IN THE GREENHOUSE

INSECT AND DISEASE CONTROL IN THE GREENHOUSE

USE AND CHARACTERISTICS OF FLOWERS, PLANTS AND DECORATIVE  
MATERIALS

ARRANGING AND DESIGNING WITH FLOWERS AND DECORATIVE MATERIALS

## PLANTING MEDIA PREPARATION

**UNIT CONCEPT:** PLANTING MEDIA (SOIL MIXTURE) IS AN ESSENTIAL COMPONENT FOR SATISFACTORY GROWTH AND DEVELOPMENT OF FLORAL PLANTS BECAUSE CERTAIN SOILS AND MIXTURES CONTAIN MORE OF THE DESIRABLE CHARACTERISTICS NEEDED BY FLORAL PLANTS. IT IS ESSENTIAL THAT THE FLORAL CROP GROWER OR GREENHOUSE OPERATOR BECOME PROFICIENT IN PROPER MEDIA PREPARATION.

### A. STUDENT PERFORMANCE OBJECTIVE

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A CHOICE OF MATERIALS, SELECT THOSE THAT MEET BASIC REQUIREMENTS, AND PREPARE THE FOLLOWING MEDIA: (1) ROOTING, (2) POTTING, (3) FINE SEEDED, ACCORDING TO INDUSTRY STANDARDS.
2. WHEN GIVEN A CHEMICAL STERILANT, DEMONSTRATE THE PROCEDURE, WITH PROPER SAFETY PRECAUTIONS, IN PASTEURIZING A BENCH OF MEDIA ACCORDING TO INDUSTRY STANDARDS.
3. WHEN GIVEN A BENCH OF MEDIA NEEDING PASTEURIZING DEMONSTRATE THE RECOMMENDED METHOD FOR STEAM PASTEURIZATION TO THE SATISFACTION OF THE INSTRUCTOR AND ACCORDING TO INDUSTRY STANDARDS.

### B. INSTRUCTIONAL AREAS

1. DETERMINING REQUIREMENTS FOR MEDIA IN RELATION TO CROP TO BE GROWN
  - A. SOIL STRUCTURE FOR AERATION
  - B. DETERMINING NUTRIENT AVAILABILITY OF SOIL MEDIA
  - C. DETERMINING PH RANGE OF SOIL MEDIA
  - D. DETERMINING EXPENSE OF VARIOUS MEDIA COMPONENTS
2. SELECTING MATERIALS TO USE IN SOIL MIXTURES

- A. TYPES OF MATERIALS USED FOR PLANTING MEDIA
- B. DETERMINING MIXTURE FOR TYPE OF PLANT MATERIAL TO BE GROWN

### 3. PASTEURIZING PLANTING MEDIA

- A. METHODS OF PASTEURIZATION
- B. SELECTING CHEMICAL FUMIGANTS TO USE
- C. APPLYING CHEMICAL FUMIGANTS
  - (1) METHODS OF APPLICATION
  - (2) PROCEDURE FOR APPLYING CHEMICAL FUMIGANTS
  - (3) DETERMINING PRECAUTIONS TO OBSERVE WHEN USING FUMIGANTS
- D. PASTEURIZING WITH STEAM
  - (1) DETERMINING PRESSURE OF STEAM
  - (2) DETERMINING AND MAINTAINING PROPER TEMPERATURE

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. PROVIDE VARIOUS MATERIALS USED IN PLANTING MEDIA AND HAVE STUDENTS IDENTIFY THE MOST COMMONLY USED ONES AND MAKE A CHART OR TABLE COMPARING ADVANTAGES AND DISADVANTAGES OF EACH.
 

B. USING VARIOUS MATERIALS, HAVE STUDENTS SELECT PROPER MATERIALS AND PREPARE PLANTING MEDIA FOR BENCHES, CONTAINERS, AND SEEDINGS. ALL STUDENTS SHOULD PREPARE AT LEAST THREE DIFFERENT SOIL MIXTURES.
2. A. HAVE STUDENTS CHEMICALLY PASTEURIZE SOIL MIXTURES USING AT LEAST TWO DIFFERENT CHEMICALS, AND COMPARE THE CHEMICALS USED ACCORDING TO EFFECTIVENESS OF PASTEURIZATION AND COST.
 

B. USING LABELS FROM CHEMICAL STERILANTS, HAVE STUDENTS LIST SAFETY PRECAUTIONS TO OBSERVE DURING AND AFTER APPLICATION.
3. HAVE STUDENTS PASTEURIZE SOIL MEDIA BY STEAMING AND THEN COMPARE WITH SOIL PASTEURIZED BY CHEMICALS.

## D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. A. HAVE EACH STUDENT LIST THE EIGHT CHARACTERISTICS OF AN IDEAL SOIL MIX WITH COMPLETE ACCURACY. THIS LIST SHOULD INCLUDE : (1) UNIFORMITY, (2) DISEASE FREE, (3) LOW SOLUBLE SALTS, (4) GOOD DRAINAGE, (5) GOOD MOISTURE RETENTION, (6) NO SHRINKAGE, (7) EASE OF PREPARATION AND STORAGE, AND (8) COMPLETE AVAILABILITY.  
  
B. WHEN GIVEN A SPECIFIC TYPE OF SOIL MIX TO PREPARE, I.E. ROOTING, POTTING OR SEEDED, EACH STUDENT SHOULD PREPARE, OR DESCRIBE AND EXPLAIN THE STEPS FOR AN APPROPRIATE MEDIA. THIS DEMONSTRATION OR DESCRIPTION SHOULD INCLUDE THESE ACTIONS: (1) SCREENING SOIL FOR UNIFORMITY OF PARTICLE SIZE, (2) MOISTENING EXTREMELY DRY MATERIALS, (3) MIXING SMALL QUANTITIES AND PROCEDURE, (4) USING CEMENT MIXER FOR LARGE QUANTITIES, AND (5) NEED FOR ADVANCE PREPARATION TO ALLOW MIX TO "EQUALIZE."
2. A. DEVELOP A MATCHING TEST USING VARIOUS CHEMICAL FUMIGANTS IN ONE COLUMN AND TYPES OF ORGANISMS TO BE CONTROLLED (FUNGI, BACTERIA, NEMATODES.) EACH STUDENT SHOULD CORRECTLY MATCH 95% OF THE MOST EFFECTIVE FUMIGANTS WITH THE ORGANISM.  
  
B. HAVE STUDENTS LIST AND EXPLAIN FACTORS TO CONSIDER IN FUMIGATING SOIL. FOR COMPLETE ACCURACY, THIS LIST SHOULD INCLUDE: (1) SOIL TEMPERATURE, (2) SOIL MIXTURE, (3) SOIL TEXTURE, (4) ORGANIC MATTER CONTENT, (5) SEALS NEEDED, (6) SOIL TYPE, AND (7) DEPTH OR APPLICATION.
3. STUDENT SHOULD DEMONSTRATE THE RECOMMENDED PROCEDURES FOR PREPARING SOIL FOR STEAM PASTEURIZATION IN THE GREENHOUSE. THIS PERFORMANCE SHOULD INCLUDE THE FOLLOWING: (1) ADDING HUMUS OR ORGANIC MATTER, (2) WATERING SOIL LIGHTLY, (3) KEEPING SOIL MOIST PRIOR TO STEAMING TO ENCOURAGE WEED GERMINATION, (4) LOOSENING THE SOIL, (5) PLACING STEAM HOSES OF SOIL IN BENCHES, (6) COVERING BENCH WITH SUITABLE COVER.

## E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. VARIOUS MEDIA MATERIALS
2. PLANTING CONTAINERS
3. CHEMICAL STERILANTS (FUMIGANTS)
4. PLANTING BENCHES

## 5. PLANTING TOOLS

## 6. STEAMING EQUIPMENT

## F. EXAMPLES OF SUPPORTING REFERENCES

1. THE GREENHOUSE WORKER. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1974, PP. 43-51.

A STUDENT REFERENCE MANUAL PREPARED FOR STUDENTS WORKING IN GREENHOUSES WHICH CONTAINS TECHNICAL INFORMATION, INSTRUCTIONS FOR MANIPULATIVE OPERATIONS, AND STUDENT EXERCISES. MATERIAL COVERED INCLUDES GREENHOUSE CONSTRUCTION, GREENHOUSE PLANTS, GREENHOUSE OPERATIONS, AND PLANTING.

2. ORNAMENTAL HORTICULTURE FOR VOCATIONAL AGRICULTURE IN ALABAMA. MONTGOMERY, ALABAMA: AGRIBUSINESS EDUCATION SERVICE, STATE DEPARTMENT OF EDUCATION. 1971, PP. 94-98.

A COMPREHENSIVE REFERENCE FOR THE STUDENT OR TEACHER IN ORNAMENTAL HORTICULTURE COVERING ALL AREAS OF THE TAXONOMY INCLUDING NURSERY, FLORAL CROP PRODUCTION, GREENHOUSE CONSTRUCTION, LANDSCAPE DESIGN, TURF CARE, AND MERCHANDISING HORTICULTURAL PLANTS AND SUPPLIES. A STUDY GUIDE IS ALSO AVAILABLE.

## GREENHOUSE PLANT PROPAGATION

**UNIT CONCEPT:** PLANT PROPAGATION CAN BE DEFINED AS THE CONTROLLED REPRODUCTION OF CERTAIN PLANTS OR CERTAIN GROUPS OF PLANTS BY MAN. THE FLORAL GREENHOUSE OPERATOR MUST MASTER THIS SKILL IN ORDER THAT AN ADEQUATE QUANTITY AND QUALITY OF FLORAL CROPS ARE AVAILABLE FOR THE CONSUMER.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A SAMPLE OF SEED, DEMONSTRATE THE VARIOUS STEPS IN THE SEEDING OPERATION FROM SEEDBED PREPARATION TO THE MAINTENANCE OF SEEDBEDS OR SEEDROWS TO THE SATISFACTION OF THE INSTRUCTOR.
2. WHEN GIVEN VARIOUS SAMPLES OF SEEDS, DEMONSTRATE PROFICIENCY IN STRATIFICATION AND SCARIFICATION TREATMENT OF SEEDS TO IMPROVE GERMINATION.
3. WHEN GIVEN VARIOUS FLORAL PLANTS, DEMONSTRATE PROFICIENCY IN LEAF-BUD, LEAF, TERMINAL BUD, STEM, AND ROOT CUTTINGS AS METHODS OF PROPAGATION, AND PREPARE THE CUTTINGS FOR ROOTING.
4. WHEN GIVEN VARIOUS TYPES OF BULBS TO BE PROPAGATED, DEMONSTRATE THE ABILITY TO SEPARATE THE SLABS OR OFFSETS AND REPLANT IN ORDER TO ACHIEVE RAPID MULTIPLICATION OF BULBS.

### B. INSTRUCTIONAL AREAS

#### 1. PROPAGATING BY SEEDING

##### A. DETERMINING SOURCES FOR SEED

##### B. TREATING SEEDS FOR INCREASED GERMINATION

- (1) IDENTIFYING METHODS OF SEED TREATMENT
- (2) DETERMINING EFFECTS OF LIGHT ON GERMINATION
- (3) PROCEDURE AND CONSIDERATIONS IN STRATIFICATION
- (4) PROCEDURE AND CONSIDERATIONS IN SCARIFICATION



### C. SEEDING OPERATIONS

- (1) DETERMINING TYPE OF SEEDING TO USE
- (2) PROCEDURE FOR SEEDBED PREPARATION AND PLANTING
- (3) PASTEURIZING SOIL MIXES
- (4) MAINTAINING ENVIRONMENTAL CONDITIONS FOR SEEDBEDS AFTER SEEDING AND TRANSPLANTING

## 2. PROPAGATING BY LEAF-CUTTINGS

- A. DETERMINING VARIETIES OR SPECIES TO BE PROPAGATED BY THIS METHOD
- B. PROCEDURE FOR MAKING CUTTINGS
- C. PLACING NEW CUTTINGS NEAR OR IN MOIST SOIL FOR GROWTH
- D. MAINTAINING ENVIRONMENTAL CONDITIONS NECESSARY FOR ROOTING

## 3. PROPAGATING BY LEAF-BUD CUTTINGS

- A. DETERMINING PLANT PORTION TO BE CUT, I.E. LEAF BLADE, PETIOLE, AND PIECE OF STEM
- B. PROCEDURE FOR BURYING CUTTING IN SOIL
- C. MAINTAINING LEAF-BUD CUTTINGS

## 4. PROPAGATION BY SEPARATION (BULBS)

- A. DETERMINING FLORAL PLANTS SUITABLE FOR PROPAGATION BY SEPARATION
- B. DETERMINING METHOD OF SEPARATION TO BE USED
- C. PROCEDURE FOR SEPARATING BULBS
- D. PLANTING BULBILS IN SOIL MEDIA (MIXTURE) FOR GROWTH

## 5. PROPAGATING BY STEM CUTTINGS

- A. CROPS PROPAGATED BY STEM CUTTINGS
- B. PROCEDURE FOR MAKING STEM CUTTINGS
- C. HANDLING OF CUTTINGS
- D. INSERTION OF CUTTINGS INTO ROOTING MEDIA

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. VISIT A SEED PRODUCER IN THE AREA (IF AVAILABLE) AND OBSERVE ACTIVITIES INVOLVED IN SEED PRODUCTION AND MAKE NOTES, PICTURES, ETC., ON PROPER SEEDBED PREPARATION, AND PLANTING TECHNIQUES.  
  
B. HAVE STUDENTS PLANT VARIOUS SEEDS AND DETERMINE AMOUNT OF TIME FOR GERMINATION.
2. A. HAVE STUDENTS SCARIFY VARIOUS SAMPLES OF SEEDS BY ALL THREE COMMON METHODS (MECHANICAL, WATER SOAKING AND ACID) IF FACILITIES ARE AVAILABLE, AND COMPARE TIME OF GERMINATION, COST, ADVANTAGES AND DISADVANTAGES OF EACH METHOD.  
  
B. HAVE STUDENTS DEMONSTRATE PROPER TECHNIQUES OF STRATIFICATION WITH VARIOUS TYPES OF SEED.
3. A. TOUR AN ESTABLISHED COMMERCIAL GREENHOUSE AND HAVE STUDENTS OBSERVE THE PROPAGATION ACTIVITIES BEING CARRIED OUT AND COMPARE VARIOUS TECHNIQUES OBSERVED IN REFERENCE TO TYPE OF PLANT PROPAGATED AND METHODS USED.  
  
B. USING CATALOGUES, HAVE STUDENTS MAKE A SMALL NOTE-BOOK IDENTIFYING THE COMMON FLORAL PLANTS AND THE MOST APPROPRIATE METHOD OF PROPAGATION. A LEAF COLLECTION MIGHT BE INCLUDED WITH THIS ACTIVITY.  
  
C. HAVE STUDENTS PLANT VARIOUS CUTTINGS (LEAF, LEAF-BUD, AND STEM) IN VARIOUS ROOTING MEDIA AND RECORD TIME AND EXTENT OF ROOT DEVELOPMENT.
4. HAVE STUDENTS PRACTICE CUTTING TRUE BULBS AS WELL AS DETACHING SLABS AND PLANTING BOTH TYPES OF BULBS.

### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. EACH STUDENT SHOULD DEMONSTRATE OR LIST THE STEPS IN THE SEEDING OPERATION WITH COMPLETE ACCURACY. THIS LIST SHOULD INCLUDE: (1) LOCATING SEED SOURCES, (2) ACQUIRING SEED, (3) TREATING SEED BY STRATIFICATION OR SCARIFICATION, (4) SEEDBED PREPARATION (INCLUDING PASTEURIZATION), (5) SEEDING, AND (6) MAINTAINING ENVIRONMENTAL CONDITIONS.
2. USING VARIOUS SEED SAMPLES, HAVE STUDENTS DETERMINE WHAT TYPE OF SEED TREATMENT, IF ANY, IS NEEDED AND THEN DEMONSTRATE OR EXPLAIN THE PROCEDURE FOR TREATING SEEDS WITH COMPLETE ACCURACY. THE EXPLANATION MUST INCLUDE SAFETY PRECAUTIONS NECESSARY.

3. EACH STUDENT SHOULD CORRECTLY DEMONSTRATE OR DESCRIBE THE PROCEDURE FOR PROPAGATING GREENHOUSE PLANTS FOR EACH OF THE FOLLOWING METHODS:

- A. LEAF-BUD
- B. LEAF
- C. STEM
- D. TERMINAL
- E. ROOT

THEIR PERFORMANCE MUST BE EVALUATED AS TO THE ADHERANCE TO INDUSTRY STANDARDS.

4. USING VARIOUS TYPES OF MATURE BULBS TO BE PROPAGATED, HAVE STUDENTS DESCRIBE OR DEMONSTRATE THE CORRECT PROCEDURE(S) FOR CUTTING "TRUE" BULBS, AS WELL AS THE PROCEDURE FOR DETACHING AND PLANTING "SCALY" BULBS SUCH AS LILIES. WITH TRUE BULBS THIS DEMONSTRATION CAN BE ACCOMPLISHED BY ONE OF TWO METHODS: (1) CUTTING INTO LONGITUDINAL PIECES SO THAT EACH SECTION CONTAINS A FRAGMENT OF STEM TISSUE OR (2) MAKING SEVERAL LONGITUDINAL CUTS THROUGH THE CENTER OF THE BULB. FOR SCALY BULBS EVALUATE STUDENTS ON ABILITY TO PROPERLY PLANT SCALES IN FLATS OF MOIST SAND OR PASTEURIZED SOIL.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. PLANTS APPROPRIATE FOR PROPAGATION METHODS DISCUSSED
2. PACKETS OF A VARIETY OF SEEDS
3. SCARIFICATION DRUM
4. SULPHURIC ACID FOR SCARIFICATION
5. ROOTING MEDIA
6. BENCHES FOR PLANTING
7. LABELS FOR CUTTINGS
8. HAND PLANTING TOOLS

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. THE GREENHOUSE WORKER. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1974, PP. 71-94.

A STUDENT REFERENCE MANUAL PREPARED FOR STUDENTS WORKING IN GREENHOUSES WHICH CONTAINS TECHNICAL INFORMATION, INSTRUCTIONS FOR MANIPULATIVE OPERATIONS, AND STUDENT EXERCISES. MATERIAL COVERED INCLUDED GREENHOUSE CONSTRUCTION, GREENHOUSE PLANTS, GREENHOUSE OPERATIONS, AND PLANTING.

2. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 149-177.

PART II OF A TWO VOLUME SET OF REFERENCE MATERIALS FOR A NURSERY WORKER COURSE OF STUDY. MATERIAL COVERED IN PART II DEALS WITH NURSERY PRACTICES INCLUDING METHODS OF PLANT PROPAGATION, FIELD PRACTICES, PEST CONTROL, MARKETING AND RECORD KEEPING.

3. ORNAMENTAL HORTICULTURE FOR VOCATIONAL AGRICULTURE IN ALABAMA. MONTGOMERY, ALABAMA: AGRIBUSINESS EDUCATION SERVICE, STATE DEPARTMENT OF EDUCATION. 1971, PP. 53-73.

A COMPREHENSIVE REFERENCE FOR THE STUDENT OR TEACHER IN ORNAMENTAL HORTICULTURE COVERING ALL AREAS OF THE TAXONOMY INCLUDING NURSERY, FLORAL CROP PRODUCTION, GREENHOUSE CONSTRUCTION, LANDSCAPE DESIGN, TURF CARE, AND MERCHANDISING HORTICULTURAL PLANTS AND SUPPLIES. A STUDY GUIDE IS ALSO AVAILABLE.

## FERTILIZATION OF FLORAL PLANTS

**UNIT CONCEPT:** BECAUSE MOST SOILS AND PLANTING MEDIA MATERIALS DO NOT CONTAIN ADEQUATE NUTRIENTS FOR OPTIMUM PLANT GROWTH, IT IS NECESSARY THAT THE GREENHOUSE WORKER BE ABLE TO CONDITION THE PLANTING MEDIA, GENERALLY BY FERTILIZATION, IN ORDER FOR FLORAL PLANTS TO ACHIEVE THE BEST GROWTH.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A MEDIA SAMPLE, DETERMINE IF A SOIL CONDITIONER IS NEEDED, AND IF SO, BLEND A SUITABLE CONDITIONER INTO A BENCH OF MEDIA ACCORDING TO INDUSTRY STANDARDS.
2. WHEN GIVEN SEVERAL FIXED ANALYSIS FERTILIZERS, DETERMINE THE POUNDS OF ACTUAL PLANT FOOD IN EACH WITHIN  $\pm$  1 POUND.
3. WHEN USING A CONCRETE MIXER, ADD MICRONUTRIENTS TO PLANT MEDIA FOR A GIVEN CROP ACCORDING TO SOIL TEST RECOMMENDATIONS.
4. WHEN USING A LIQUID FERTILIZER APPLICATOR SYSTEM, DEMONSTRATE THE PROCEDURE TO FERTILIZE A BENCH OF FLORAL CROPS TO THE SATISFACTION OF THE INSTRUCTOR.

### B. INSTRUCTIONAL AREAS

1. SELECTING FERTILIZERS FOR FLORAL CROPS
  - A. DETERMINING FERTILIZER COMPONENTS
  - B. DETERMINING ANALYSIS AND AMOUNT OF FERTILIZER NEEDED FOR A GIVEN CROP
    - (1) INTERPRETING SOIL TEST RESULTS
    - (2) DETERMINING COST PER POUND OF NUTRIENTS
2. APPLYING FERTILIZERS TO PLANTING MEDIA FOR A GIVEN CROP

- A. SELECTING MOST APPROPRIATE METHOD OF APPLYING LIQUID FERTILIZER
  - B. SELECTING MOST APPROPRIATE METHOD OF APPLYING DRY FERTILIZERS
  - C. DETERMINING TIME OF APPLICATION
  - D. PROCEDURE FOR APPLYING LIQUID FERTILIZERS IN THE GREENHOUSE
  - E. PROCEDURE FOR APPLYING GRANULAR (DRY) FERTILIZER TO SOIL MEDIUM FOR A GIVEN CROP
  - F. SAFETY PRECAUTIONS TO CONSIDER IN APPLYING FERTILIZER
  - G. CLEANING FERTILIZER APPLICATORS AFTER USE
  - H. PROCEDURES FOR SAFE STORAGE OF FERTILIZER MATERIAL
3. ADDING MICRONUTRIENTS TO SOIL MIXTURES FOR A GIVEN CROP
- A. DETERMINING NEEDS FOR MICRONUTRIENTS
  - B. SELECTING MICRONUTRIENTS FOR APPLICATION
  - C. PROCEDURE FOR MIXING MICRONUTRIENTS

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. HAVE STUDENTS SAMPLE SOIL MEDIA AND SEND SAMPLES FOR TESTING TO AN ESTABLISHED LABORATORY AND REVIEW AND INTERPRET RECOMMENDATIONS WHEN THEY RETURN.
- 2. WITH SEVERAL VARIOUS FERTILIZER BAGS, HAVE STUDENTS STUDY INFORMATION ON THE BAG. LOOK FOR SUCH THINGS AS ANALYSIS, POUNDS OF NUTRIENTS, CONTENTS AND INFORMATION ON PROPER APPLICATION.
- 3. HAVE STUDENTS BLEND SOIL CONDITIONERS AND/OR MICRONUTRIENTS IN MEDIA WITH A CONCRETE MIXER OR OTHER SIMILAR MECHANICAL METHOD.
- 4.
  - A. HAVE STUDENTS APPLY FERTILIZER IN GRANULAR AND LIQUID FORM TO A FIELD PLOT OR BENCH OF SOIL MEDIA.
  - B. USING VARIOUS FERTILIZER APPLICATORS, HAVE STUDENTS CLEAN THEM ADEQUATELY FOR STORAGE.

## D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. EACH STUDENT SHOULD BE ABLE TO LIST THE STEPS NECESSARY TO DETERMINE IF FERTILIZATION IF NEEDED, AND IF SO, WHAT AMOUNTS FOR A GIVEN FLORAL CROP(S). THIS LIST OF STEPS SHOULD INCLUDE: (1) TAKING A REPRESENTATIVE SOIL SAMPLE (PROCEDURE), (2) PREPARING SAMPLE FOR ANALYSIS, (3) INTERPRETING ANALYSIS INFORMATION, AND (4) SELECTING FERTILIZER(S) NEEDED.
2. USING FERTILIZER LABEL INFORMATION ABOUT ANALYSIS, HAVE EACH STUDENT FIGURE THE POUNDS OF ACTUAL PLANT FOOD FOR GIVEN AMOUNTS OF FERTILIZER. THIS DETERMINATION MUST BE WITHIN  $\pm 1$  POUND. THEY SHOULD ALSO DETERMINE THE COST PER POUND OF VARIOUS ANALYSES.
3. ASSIGN A BENCH OF FLORAL CROPS SHOWING NUTRIENT DEFICIENCIES TO EACH STUDENT AND GIVE HIM RESPONSIBILITY FOR TESTING THE MEDIA, INTERPRETING TEST RESULTS, AND CARRYING OUT THE RECOMMENDATIONS. THE EVALUATION OF THIS EXERCISE WOULD BE THE EFFECTIVENESS OF HIS PERFORMANCE, I.E. DID THE ASSIGNED FLORAL CROP RESPOND TO THE FERTILIZER TREATMENT(S).
4. EACH STUDENT SHOULD LIST THE FACTORS TO CONSIDER IN SELECTING A GOOD LIQUID FERTILIZER PROPORTIONER FOR THE GREENHOUSE. THESE FACTORS MUST INCLUDE: (1) RELIABILITY, (2) CAPACITY, (3) ACCURACY, AND (4) COSTS.

## E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. FERTILIZER OF VARYING ANALYSES INCLUDING MICRONUTRIENTS
2. SPRAYERS (LIQUID AND TANK)
3. FERTILIZER INJECTORS (HOZON)
4. FERTILIZER BAGS FOR STUDYING INFORMATION
5. SOIL TESTING MAILING KITS (THESE CAN GENERALLY BE ACQUIRED IN COUNTY EXTENSION OFFICES)

## F. EXAMPLES OF SUPPORTING REFERENCES

1. THE GREENHOUSE WORKER. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1974, PP. 56-64.



A STUDENT REFERENCE MANUAL PREPARED FOR STUDENTS WORKING IN GREENHOUSES WHICH CONTAINS TECHNICAL INFORMATION, INSTRUCTIONS FOR MANIPULATIVE OPERATIONS, AND STUDENT EXERCISES. MATERIAL COVERED INCLUDES GREENHOUSE CONSTRUCTION, GREENHOUSE PLANTS, GREENHOUSE OPERATIONS, AND PLANTING.

2. ORNAMENTAL HORTICULTURE FOR VOCATIONAL AGRICULTURE IN ALABAMA. MONTGOMERY, ALABAMA: AGRIBUSINESS EDUCATION SERVICE, STATE DEPARTMENT OF EDUCATION. 1971, PP. 86-92.

A COMPREHENSIVE REFERENCE FOR THE STUDENT OR TEACHER IN ORNAMENTAL HORTICULTURE COVERING ALL AREAS OF THE TAXONOMY INCLUDING NURSERY, FLORAL CROP PRODUCTION, GREENHOUSE CONSTRUCTION, LANDSCAPE DESIGN, TURF CARE, AND MERCHANDISING HORTICULTURAL PLANTS AND SUPPLIES. A STUDY GUIDE IS ALSO AVAILABLE.

## MAINTAINING DESIRABLE ENVIRONMENTAL CONDITIONS IN THE GREENHOUSE

**UNIT CONCEPT:** FLORAL CROPS VARY IN THEIR REQUIREMENTS FOR AIR, TEMPERATURE, LIGHT AND MOISTURE AND ALL OF THESE REQUIREMENTS CAN BE PROVIDED IN THE RIGHT AMOUNTS AND UNDER THE PROPER CONDITIONS IN THE GREENHOUSE. THE WORKER MUST BE ABLE TO REGULATE AND MAINTAIN THE GREENHOUSE ENVIRONMENT TO PROVIDE OPTIMUM CONDITIONS FOR GROWING PLANTS, AS WELL AS REGULATING THE GROWTH OF THE CROP FOR QUALITY AND TIMELINESS OF MARKETING.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN CROPS TO BE GROWN IN THE GREENHOUSE AND APPROPRIATE REFERENCES, DETERMINE THE GREENHOUSE ENVIRONMENTAL CONDITIONS NEEDED FOR THE CROPS TO THE SATISFACTION OF THE INSTRUCTOR.
2. WHEN GIVEN FLORAL CROPS TO BE GROWN AND AN EQUIPPED GREENHOUSE, DEMONSTRATE THE ABILITY TO OPERATE THE HEATING, VENTILATING AND COOLING SYSTEMS TO MAINTAIN A SPECIFIED TEMPERATURE AND HUMIDITY.
3. WHEN GIVEN FLORAL CROPS TO BE GROWN AND AN EQUIPPED GREENHOUSE, DEMONSTRATE THE ABILITY TO OPERATE AND MAINTAIN AUTOMATIC WATERING SYSTEMS AND TO HAND WATER POT, BENCH AND BEDGROWN CROPS ACCORDING TO SPECIFIED PROCEDURES.
4. WHEN GIVEN SPECIFIC FLORAL CROPS OR A VARIETY OF FLORAL CROPS OR A VARIETY OF FLORAL CROPS AND AN EQUIPPED GREENHOUSE, OPERATE AND MAINTAIN LIGHTING AND SHADING SYSTEMS TO PROVIDE OPTIMUM CONDITIONS FOR THE GIVEN PLANTS ACCORDING TO SPECIFIED PROCEDURES.

### B. INSTRUCTIONAL AREAS

1. MAINTAINING DESIRABLE GREENHOUSE TEMPERATURES AND HUMIDITY
  - A. DETERMINING EFFECT OF TEMPERATURE ON PLANTS
  - B. RELATIONSHIP OF TEMPERATURE AND HUMIDITY ON PLANT GROWTH
  - C. DETERMINING SPECIFIC CROP REQUIREMENTS

- D. IDENTIFYING EQUIPMENT AND METHODS USED TO CONTROL TEMPERATURE AND HUMIDITY
    - (1) CAPACITY IN BTU'S NEEDED TO MEET SPECIFIC FACILITY REQUIREMENTS
  - E. REGULATING AND OPERATING EQUIPMENT TO MAINTAIN DESIRED TEMPERATURE AND HUMIDITY
    - (1) OPERATING TIMING EQUIPMENT
    - (2) ADJUSTING HEATING AND COOLING EQUIPMENT
    - (3) PROCEDURE FOR SHADING IN THE GREENHOUSE
    - (4) REGULATING TEMPERATURES FOR SEASONAL DIFFERENCES
  - F. PERFORMING SIMPLE MAINTENANCE OF HEATING AND COOLING EQUIPMENT
    - (1) HEATERS
    - (2) VENTILATORS
    - (3) COOLING EQUIPMENT
    - (4) CONTROL DEVICES
2. MAINTAINING MOISTURE REQUIREMENTS FOR FLORAL PLANTS
- A. DETERMINING MOISTURE NEEDS OF CROP(S) TO BE GROWN
  - B. SELECTING WATERING EQUIPMENT
    - (1) TYPES OF EQUIPMENT AVAILABLE
    - (2) RELATIONSHIP OF CROP MOISTURE NEEDS TO OTHER OPTIMUM ENVIRONMENTAL CONDITIONS REQUIRED
    - (3) EFFECT OF TYPE OF SOIL MIX ON WATER REQUIREMENTS AND PROCEDURE
  - C. DETERMINING TIME AND FREQUENCY OF WATERING
  - D. PROVIDING MOISTURE BY SUB-SURFACE METHODS
  - E. SETTING UP AND REGULATING EQUIPMENT
  - F. MAINTAINING WATERING EQUIPMENT
    - (1) REPLACING NOZZLES
    - (2) ADJUSTING TIMERS AND OTHER AUTOMATIC CONTROLS
3. MAINTAINING OPTIMUM LIGHTING CONDITIONS
- A. DETERMINING LIGHT REQUIREMENTS FOR CROP TO BE GROWN
    - (1) LIGHT INTENSITY REQUIREMENTS
    - (2) PHOTOPERIOD REQUIREMENTS
    - (3) RELATIONSHIP BETWEEN LIGHT, TEMPERATURE AND HUMIDITY IN THE GREENHOUSE.

- B. SELECTING METHODS OF LIGHTING
  - C. PROCEDURE FOR REGULATING LIGHTING FOR OPTIMUM GROWTH AND DEVELOPMENT
  - D. PROCEDURE FOR REGULATING LIGHTING FOR TIMELINESS OF MARKETING
  - E. MAINTENANCE PROCESSES FOR LIGHTING EQUIPMENT
4. MAINTAINING OPTIMUM CARBON DIOXIDE LEVEL IN THE GREENHOUSE
- A. METHODS OF PROVIDING ADEQUATE CO<sub>2</sub>
  - B. RELATIONSHIP OF CO<sub>2</sub> AND VENTILATION
  - C. SELECTING EQUIPMENT FOR GENERATING ADDITIONAL CO<sub>2</sub> IN THE GREENHOUSE
  - D. INSTALLATION AND OPERATION OF CO<sub>2</sub> GENERATORS
  - E. MAINTAIN CO<sub>2</sub> GENERATING EQUIPMENT

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. ASSIGN STUDENTS WITH SPECIFIC FLORAL PLANTS AND HAVE THEM PREPARE A REPORT ON EQUIPMENT AND CONTROLS NEEDED TO MAINTAIN OPTIMUM ENVIRONMENTAL CONDITIONS FOR THEIR PARTICULAR CROP. IT MIGHT BE WELL TO ASSIGN MORE THAN ONE TYPE OF CROP TO EACH STUDENT FOR HIS "GREENHOUSE" IN ORDER TO PERMIT STUDENTS TO RECOMMEND A SYSTEM TO TAKE CARE OF THE VARYING CROPS IN ONE "GREENHOUSE."
- B. VISIT A LOCAL COMMERCIAL GREENHOUSE AND OBSERVE EQUIPMENT USED FOR MAINTAINING ENVIRONMENTAL CONDITIONS AND HAVE STUDENTS WORK AS SMALL GROUPS TO MAKE RECOMMENDATIONS FOR A BETTER SYSTEM.
2. USING VARIOUS AUTOMATIC CONTROL DEVICES, HAVE STUDENTS PRACTICE REGULATING A "SIMULATION" GREENHOUSE FOR VARIOUS FLORAL PLANTS WHICH MIGHT BE GROWN IN THE GREENHOUSE.
3. ASSIGN STUDENTS ON A ROTATING BASIS TO BE RESPONSIBLE FOR REGULATING SPECIFIC CONDITIONS (TEMPERATURE, MOISTURE, ETC.) IN THE SCHOOL GREENHOUSE.
4. HAVE STUDENTS SET UP EXPERIMENTS TO STUDY THE EFFECT OF VARYING LIGHT INTENSITIES AND PHOTOPERIODS ON SEVERAL FLORAL CROPS. PLANTS COULD ALSO BE GROWN USING VARYING METHODS OF PROVIDING LIGHT, SUCH AS:

NATURAL SUNLIGHT, FLUORESCENT LIGHTING, "SHADE," "BLACK PLASTIC" TREATMENT, ETC., AND THESE COULD BE COMPARED AT VARIOUS INTERVALS. OTHER SIMILAR EXPERIMENTS CAN BE CONDUCTED TO STUDY HUMIDITY, MOISTURE, TEMPERATURE, ETC.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING REFERENCES AND SPECIFIC GREENHOUSE CROPS, EACH STUDENT SHOULD BE REQUIRED TO DETERMINE THE MOISTURE, TEMPERATURE, LIGHT, AND CARBON DIOXIDE REQUIREMENTS WITH 95% ACCURACY. THIS EVALUATION SHOULD INCLUDE SEVERAL COMMONLY GROWN GREENHOUSE PLANTS.
2. HAVE EACH STUDENT OPERATE OR EXPLAIN ORALLY OR IN WRITING, THE CORRECT PROCEDURE FOR REGULATING TEMPERATURE IN THE GREENHOUSE. THIS SHOULD BE EVALUATED ACCORDING TO THE OPERATOR'S MANUAL FOR THE EQUIPMENT USED IN THE SCHOOL GREENHOUSE.
3. EACH STUDENT SHOULD BE ABLE TO CORRECTLY LIST AND DESCRIBE AT LEAST THREE METHODS OF PROVIDING ADEQUATE MOISTURE FOR GREENHOUSE CROPS. THIS LIST SHOULD INCLUDE HAND WATERING, HOSES IN BENCHES, AND MIST SYSTEMS.
4. USING A LIST OF COMMONLY GROWN GREENHOUSE CROPS, HAVE STUDENTS SELECT THOSE AFFECTED BY DAY LENGTH (PHOTO-PERIOD) WITH COMPLETE ACCURACY. EXAMPLES OF TWO CROPS THAT MAY BE USED ARE CHRYSANTHEMUMS AND POINSETTIAS.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. COMMERCIAL CATALOGUES, SLIDES SETS OR OTHER ILLUSTRATIVE MATERIALS WITH ILLUSTRATIONS OF "ENVIRONMENTAL CONTROL" EQUIPMENT. THIS SHOULD INCLUDE HEATERS, FANS, LIGHT CONTROL SYSTEMS, AUTOMATIC CONTROL DEVICES, CARBON DIOXIDE GENERATORS AND WATERING EQUIPMENT. IT IS DESIRABLE TO HAVE A VARIETY OF ACTUAL PIECES OF EQUIPMENT FOR ILLUSTRATION.
2. THERMOSTATS, AUTOMATIC TIMERS AND OTHER COMMON CONTROL DEVICES COMMONLY FOUND IN GREENHOUSES.
3. AN "AUTOMATICALLY CONTROLLED" GREENHOUSE IS DESIRABLE FOR EXPERIENCE WITH THIS TYPE OF SET-UP BUT NOT ABSOLUTELY NECESSARY. STUDENTS MUST ALSO HAVE EXPERIENCE WITH "LESS THAN IDEAL" FACILITIES.

## F. EXAMPLES OF SUPPORTING REFERENCES

1. THE GREENHOUSE WORKER. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1974. PP. 15-42.

A STUDENT REFERENCE MANUAL PREPARED FOR STUDENTS WORKING IN GREENHOUSES WHICH CONTAINS TECHNICAL INFORMATION, INSTRUCTIONS FOR MANIPULATIVE OPERATIONS, AND STUDENT EXERCISES. MATERIAL COVERED INCLUDES GREENHOUSE CONSTRUCTION, GREENHOUSE PLANTS, GREENHOUSE OPERATIONS, AND PLANTING.

2. ORNAMENTAL HORTICULTURE SOURCE UNITS FOR VOCATIONAL TEACHERS. DANVILLE, ILLINOIS: INTERSTATE PRINTERS AND PUBLISHERS. PP. 53-72.

A PUBLICATION DIVIDED INTO SEVEN HORTICULTURAL AREAS (TURF, PLANT PROPAGATION, GREENHOUSE MANAGEMENT, ARBORICULTURE, NURSERY MANAGEMENT, LANDSCAPING, AND FLOWERS AND FLORAL ARRANGEMENTS) WHICH CONTAIN PROBLEM AREA OUTLINES, TEACHING AIDS, LABORATORY EXERCISES AND STUDY QUESTIONS AND ANSWERS FOR EACH OF THE FIVE AREAS.

3. ORNAMENTAL HORTICULTURE FOR VOCATIONAL AGRICULTURE IN ALABAMA. MONTGOMERY, ALABAMA: AGRIBUSINESS EDUCATION SERVICE, STATE DEPARTMENT OF EDUCATION. 1971, PP. 101-106.

A COMPREHENSIVE REFERENCE FOR THE STUDENT OR TEACHER IN ORNAMENTAL HORTICULTURE COVERING ALL AREAS OF THE TAXONOMY INCLUDING NURSERY, FLORAL CROP PRODUCTION, GREENHOUSE CONSTRUCTION, LANDSCAPE DESIGN, TURF CARE, AND MERCHANDISING HORTICULTURAL PLANTS AND SUPPLIES. A STUDY GUIDE IS ALSO AVAILABLE.

4. A TWO-YEAR PROGRAM IN VOCATIONAL HORTICULTURE, SECTION II. ST. PAUL, MINNESOTA: AGRICULTURAL EDUCATION DEPARTMENT, STATE DEPARTMENT OF VOCATIONAL EDUCATION. PP. 647-670.

THIS TWO PART MIMEOGRAPHED REFERENCE CONTAINS TEACHER DEVELOPED MATERIALS WHICH COVER MANY OF THE TOPICS COVERED IN THIS UNIT.

## INSECT AND DISEASE CONTROL IN THE GREENHOUSE

**UNIT CONCEPT:** INSECT AND DISEASE DAMAGE TO FLORAL CROPS CAN SERIOUSLY AFFECT GROWTH AND, IN TURN, SERIOUSLY AFFECT RETURNS FOR FLORAL CROPS. THEREFORE, THE GREENHOUSE (FLORICULTURE) WORKER MUST BE FAMILIAR WITH THE INSECTS AND DISEASES THAT CAN DAMAGE CROPS AND BE ABLE TO APPLY EFFECTIVE CONTROLS TO REDUCE LOSSES.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN FLORAL PLANT SPECIMENS COMMON TO THE AREA THAT ARE DAMAGED BY DISEASE, INSECTS OR OTHER PESTS, RECOGNIZE THE SOURCE OF THE DAMAGE, EITHER ON SIGHT OR BY USING A RECOGNIZED REFERENCE.
2. WHEN GIVEN SPECIFIC FLORAL PEST PROBLEMS, CARRY OUT RECOMMENDED PROCEDURES FOR CONTROLLING THE PROBLEM(S) USING CHEMICALS, CULTURAL AND/OR MECHANICAL METHODS ACCORDING TO INDUSTRY STANDARDS.
3. WHEN GIVEN A VARIETY OF FLORAL CROPS IN A GREENHOUSE, IMPLEMENT A PREVENTATIVE PROGRAM FOR PEST CONTROL TO THE SATISFACTION OF THE TEACHER OR EMPLOYER.

### B. INSTRUCTIONAL AREAS

1. CONTROLLING FLORAL DISEASES
  - A. DETERMINING UNDESIRABLE EFFECTS OF DISEASES
  - B. IDENTIFYING DISEASED PLANTS
  - C. IDENTIFYING SOURCES OF FLORAL CROP DISEASES
  - D. USING VARIOUS METHODS OF DISEASE CONTROL
    - (1) ACQUIRING AND USING RESISTANT VARIETIES
    - (2) USING CULTURAL METHODS OF CONTROL
      - (A) SEEDBED PREPARATION



- (3) CONTROLLING DURING "LIFE CYCLE" OF DISEASE ORGANISMS
- (4) USING CHEMICAL CONTROL MEASURES
  - (A) SELECTING EQUIPMENT
  - (B) CALIBRATING APPLICATION EQUIPMENT
  - (C) SAFETY PRECAUTIONS TO FOLLOW IN APPLYING CHEMICALS
  - (D) STORING CHEMICALS

## 2. CONTROLLING FLORAL PLANT INSECTS AND OTHER PESTS

- A. IDENTIFYING INSECT DAMAGE OF FLORAL PLANTS
  - (1) LOCATING PLANT PARTS SHOWING DAMAGE
- B. STUDYING INSECT LIFE CYCLES TO DETERMINE MOST VULNERABLE TIME FOR CONTROL
  - (1) DETERMINING "BEST" GROWTH STAGE FOR CONTROL
  - (2) TIME OF SEASON FOR CONTROL
- C. SELECTING METHOD(S) OF CONTROL
  - (1) USING BIOLOGICAL CONTROLS
  - (2) USING NATURAL CONTROLS AVAILABLE
  - (3) USING CULTURAL CONTROLS
  - (4) USING CHEMICAL CONTROLS
  - (5) USING SOIL STERILIZATION FOR CONTROL
- D. DETERMINING INSECT AND OTHER PEST CONTROL MEASURES TO USE
  - (1) IDENTIFYING INSECT OR PEST CAUSING DAMAGE
  - (2) PRESCRIBING EFFECTIVE CONTROL FROM RECOGNIZED REFERENCES
  - (3) APPLYING THE MOST EFFECTIVE CONTROL MEASURES

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. USING REFERENCES THAT DESCRIBE DISEASES IN THE LOCAL AREA, STUDENTS SHOULD IDENTIFY THE CAUSE AND RECOMMENDED CONTROL MEASURES FOR VARIOUS PLANT SPECIMENS OR SLIDES OF DISEASED TURF PLANTS.
 

B. HAVE STUDENTS PREPARE MOUNTED SPECIMENS OR DISPLAYS OF PLANTS SHOWING VARIOUS PLANT PEST SYMPTOMS OR CHARACTERISTICS.
2. USING VARIOUS PESTICIDE LABELS, HAVE STUDENTS GIVE ALL PRECAUTIONARY MEASURES TO BE OBSERVED WHEN USING A PARTICULAR SUBSTANCE.

3. HAVE STUDENTS SET UP A PREVENTATIVE CONTROL PROGRAM FOR DISEASES, INSECTS AND OTHER PESTS FOR A SPECIFIC GROUP OF FLORAL CROPS OR SECTION OF THE SCHOOL GREENHOUSE. THIS MAY ALSO BE DONE FOR STUDENTS PLACED IN COMMERCIAL GREENHOUSES FOR THEIR OCCUPATIONAL WORK EXPERIENCE.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. DEVELOP A MATCHING TEST USING PICTURES, SLIDES OR OTHER VISUAL AIDS THAT SHOW FLORAL PLANTS AFFECTED BY INSECTS AND DISEASES, AND HAVE STUDENTS INDICATE CAUSE OF DAMAGE OR MOST APPROPRIATE CONTROL METHOD TO USE. THIS SHOULD BE COMPLETED WITH 95% ACCURACY.
2. EACH STUDENT SHOULD BE ABLE TO LIST AND EXPLAIN THE SAFETY PRECAUTIONS ONE MUST FOLLOW WHEN APPLYING CHEMICALS TO CONTROL INSECTS AND DISEASES. THIS LIST SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) READING LABEL DIRECTIONS, (2) WEARING PROTECTIVE CLOTHING, (3) PROPER MIXING PROCEDURE, (4) CLEANING AND WASHING AFTER APPLICATION.
3. GIVE EACH STUDENT A SPECIFIC FLORAL CROP AND HAVE THEM OUTLINE THE FACTORS TO CONSIDER WHEN DEVELOPING A PREVENTIVE CONTROL PROGRAM FOR INSECTS AND DISEASES. THIS OUTLINE SHOULD INCLUDE: (1) IDENTIFYING POTENTIAL INSECT AND DISEASE PROBLEMS, (2) METHODS OF CONTROL, (3) TIME OF APPROPRIATE FOR CONTROL.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. PLANT SPECIMENS, SLIDES, FILMSTRIPS OR PICTURES SHOWING VARIOUS INSECT, DISEASE OR PEST DAMAGE.
2. REFERENCES OUTLINING CONTROL MEASURES FOR COMMON LOCAL INSECTS, DISEASES OR PESTS.

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. THE GREENHOUSE WORKER. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1974, PP. 65-71.

A STUDENT REFERENCE MANUAL PREPARED FOR STUDENTS WORKING IN GREENHOUSES WHICH CONTAINS TECHNICAL INFORMATION, INSTRUCTIONS FOR MANIPULATIVE OPERATIONS, AND STUDENT EXERCISES. MATERIAL COVERED INCLUDES GREENHOUSE CONSTRUCTION, GREENHOUSE PLANTS, GREENHOUSE OPERATIONS, AND PLANTING.

2. ORNAMENTAL HORTICULTURE FOR VOCATIONAL AGRICULTURE IN ALABAMA. MONTGOMERY, ALABAMA: AGRIBUSINESS EDUCATIONAL SERVICE, STATE DEPARTMENT OF EDUCATION. 1971, PP. 224-269.

A COMPREHENSIVE REFERENCE FOR THE STUDENT OR TEACHER IN ORNAMENTAL HORTICULTURE COVERING ALL AREAS OF THE TAXONOMY INCLUDING NURSERY, FLORAL CROP PRODUCTION, GREENHOUSE CONSTRUCTION, LANDSCAPE DESIGN, TURF CARE, AND MERCHANDISING HORTICULTURAL PLANTS AND SUPPLIES. A STUDY GUIDE IS ALSO AVAILABLE.

## USE AND CHARACTERISTICS OF FLOWERS, PLANTS AND DECORATIVE MATERIALS

**UNIT CONCEPT:** SUCCESSFUL EMPLOYMENT IN A FLORAL BUSINESS DEPENDS LARGELY UPON KNOWLEDGE OF THE USE AND THE CHARACTERISTICS OF A HIGHLY PERISHABLE PRODUCT -- FLORAL CROPS. THE EMPLOYEE MUST BE FAMILIAR WITH THE NAMES OF PRODUCTS WITH WHICH HE IS RESPONSIBLE IN ORDER TO SELECT THE MOST APPROPRIATE FLORAL CROPS TO MEET THE CONSUMERS' DESIRES AND NEEDS.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN VARIOUS COMMON CUT FLOWERS FOUND IN LOCAL FLORAL BUSINESSES, IDENTIFY EACH BY NAME AND GIVE ITS IDENTIFYING CHARACTERISTICS ACCORDING TO REFERENCES CITED IN THIS UNIT.
2. WHEN GIVEN FOLIAGE AND FLOWERING POT PLANTS COMMONLY FOUND IN LOCAL FLORAL BUSINESSES, IDENTIFY EACH BY NAME AND GIVE ITS MOST COMMON USES TO THE SATISFACTION OF THE INSTRUCTOR.
3. WHEN GIVEN A VARIETY OF GREENS USED FOR DESIGN WORK, IDENTIFY EACH AND GIVE ITS COMMON USES IN DESIGN TO THE SATISFACTION OF THE EMPLOYER OR TEACHER.
4. WHEN GIVEN DECORATIVE MATERIALS SUCH AS CONTAINERS, RIBBONS, NETTING AND HOLDING DEVICES, RECOGNIZE EACH AND DETERMINE HOW EACH IS USED IN FLORAL DESIGN TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER.

### B. INSTRUCTIONAL AREAS

1. IDENTIFYING CUT FLOWERS USED IN FLORAL DESIGN
  - A. DETERMINING COLORS OF COMMON FLOWERS
  - B. IDENTIFYING FLOWER VARIETIES PROVIDING COLORS
  - C. IDENTIFYING ON THE BASIS OF SHAPE OF FLOWER AND STEM
  - D. DETERMINING SEASON OF FLOWER PRODUCTION AND AVAILABILITY

- E. DETERMINING KEEPING QUALITY OF CUT FLOWERS
- F. DETERMINING COMMON USES OF SPECIFIC CUT FLOWERS
- G. USING REFERENCES AND IDENTIFICATION KEYS
- 2. IDENTIFYING FOLIAGE AND FLOWERING POT PLANTS
  - A. IDENTIFYING ON THE BASIS OF LEAF SHAPE AND SIZE
  - B. IDENTIFYING FOLIAGE PLANTS ON BASIS OF LEAF COLORING
  - C. DETERMINING VARIETY AND SPECIES ON THE BASIS OF COLOR OF FLOWERS
  - D. DETERMINING METHOD OF PRICING FOLIAGE AND FLOWERING POT PLANTS
  - E. DETERMINING SEASON OF AVAILABILITY
  - F. USING REFERENCES AND IDENTIFICATION KEYS
- 3. IDENTIFYING AND RECOGNIZING GREENS USED FOR FLORAL DESIGN
  - A. DETERMINING LEAF CHARACTERISTICS
  - B. IDENTIFYING COLOR PATTERNS FOR GREENS
  - C. DETERMINING MOST POPULAR GREENS AND THEIR USES
  - D. USING IDENTIFICATION KEYS
  - E. DETERMINING STORAGE QUALITY OF VARIOUS FLORIST GREENS
- 4. RECOGNIZING DECORATIVE MATERIALS USED IN FLORAL DESIGN
  - A. IDENTIFYING AND SELECTING COMMON CONTAINERS FOR FLORAL PLANTS
  - B. RECOGNIZING COMMONLY USED TYPES AND QUALITIES OF RIBBONS USED IN DESIGN
  - C. IDENTIFYING AND SELECTING NETTING
  - D. RECOGNIZING HOLDING DEVICES USED IN FLORAL DESIGN

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. USE A SERIES OF COLOR SLIDES, CATALOGUE PICTURES, OR OTHER TECHNIQUE TO ILLUSTRATE THE USE OF DIFFERENT FLOWERS, PLANTS, AND DECORATIVE MATERIALS. THIS CAN BE USED FOR INDIVIDUAL STUDENT STUDY.

2. USING COMMONLY FOUND CUT FLOWERS, HAVE STUDENTS OBSERVE THE KEEPING QUALITY OF THESE OVER A PERIOD OF TIME.
3. VISIT A FLORAL SHOP AND HAVE STUDENTS IDENTIFY THE FLORAL PLANTS OFFERED FOR SALE, AS WELL AS NOTING IDENTIFYING CHARACTERISTICS AND COMMON USES OF EACH.
4. USING A SMALL GROUP APPROACH, LET STUDENTS PHOTOGRAPH VARIOUS FLORAL PLANTS FOUND AROUND THE SCHOOL AND HOME AND MAKE IDENTIFICATION SETS FOR CLASS STUDY. ONE GROUP COULD CONCENTRATE ON CUT FLOWERS; ANOTHER ON FOLIAGE PLANTS, AND ANOTHER ON FLOWER PLANTS.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING SLIDES, PHOTOGRAPHS OR DRAWINGS, DEVELOP A MATCHING TEST FOR COMMON CUT FLOWERS, FOLIAGE OR FLOWERING POT PLANTS, AND HAVE STUDENTS MATCH THE PICTURES WITH THE COMMON NAME WITH COMPLETE ACCURACY.
2. EACH STUDENT SHOULD BE ABLE TO DESCRIBE ORALLY OR IN WRITING THE COMMON USES OF COMMONLY FOUND FLOWERING POT PLANTS. THIS DESCRIPTION MIGHT TAKE THE FORM OF A MATCHING TEST WHERE STUDENTS MATCH THE PLANT WITH ITS MOST COMMON USE, I.E. POINSETTIA MATCHED WITH CHRISTMAS DECORATION.
3. EACH STUDENT, WHEN GIVEN AN ASSORTMENT OF FLORIST GREENS SHOULD BE ABLE TO DISTINGUISH BETWEEN THOSE THAT ARE FRESH AND THOSE THAT ARE OLD. FACTORS THE STUDENT SHOULD USE TO MAKE THIS DETERMINATION ARE: (1) COLOR OF GREENS, (2) CONDITION OF LEAVES AND STEMS (BRITTLE OR PLIABLE), AND (3) KEEPING QUALITY.
4. USING ACTUAL CONTAINERS OR AN ASSORTMENT OF PICTURES ILLUSTRATING CONTAINERS, HAVE STUDENTS MATCH THESE WITH ITS COMMON NAMES. TYPES OF CONTAINERS MIGHT INCLUDE: (1) CYLINDER, (2) PEDESTAL, (3) CUP (PAPER MACHE'), (4) MILK GLASS VASE, AND (5) BOWL (POTTERY). CONTAINERS USED FOR EVALUATION SHOULD BE THOSE MOST COMMONLY USED IN LOCAL FLORAL BUSINESSES.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. COMMERCIAL CATALOGUES FOR IDENTIFICATION OF FLORAL PLANTS.
2. EXAMPLES OF LIVE PLANT MATERIAL I.E. CUT FLOWERS, FOLIAGE PLANTS, FLOWERING PLANTS AND FLORAL GREENS.

3. IDENTIFICATION KEYS IF AVAILABLE
4. GREENS COMMONLY USED IN FLORAL DESIGNS
5. CONTAINERS, VARIOUS TYPES OF RIBBONS, NETTING AND HOLDING DEVICES COMMONLY USED IN FLORAL ARRANGING.

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. FLORIST SALES AND SERVICE. EAST LANSING, MICHIGAN: DEPARTMENT OF SECONDARY EDUCATION AND CURRICULUM. 1969, PP. 12-15.

ONE OF A SERIES OF UNITS OF INSTRUCTION DEVELOPED BY TEACHERS DESIGNED TO BE USED AS STUDENT MANUALS IN AN INDIVIDUALIZED INSTRUCTION SITUATION AND UNDER THE GUIDANCE OF THE TEACHER. MATERIAL INCLUDES STORE LAYOUTS, FLORIST PRODUCTS, DISPLAYING THE PRODUCTS, ADVERTISING, SALESMANSHIP, HUMAN RELATIONS, ARRANGING, AND FINANCING.

2. THE GREENHOUSE WORKER. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1974, 152 PAGES.

A STUDENT REFERENCE MANUAL PREPARED FOR STUDENTS WORKING IN GREENHOUSES WHICH CONTAINS TECHNICAL INFORMATION, INSTRUCTIONS FOR MANIPULATIVE OPERATIONS, AND STUDENT EXERCISES. MATERIAL COVERED INCLUDES GREENHOUSE CONSTRUCTION, GREENHOUSE PLANTS, GREENHOUSE OPERATIONS, AND PLANTING.

3. RETAIL FLOWER SHOP OPERATION AND MANAGEMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: AGRICULTURAL EDUCATION DEPARTMENT, THE PENNSYLVANIA STATE UNIVERSITY. 1967, PP. 11-52.

THIS IS AN EXCELLENT REFERENCE FOR THE UNIT WHICH CONTAINS PHOTOGRAPHS OF COMMONLY USED FLORAL PLANTS AND CUT FLOWERS AS WELL AS INFORMATION ABOUT CHARACTERISTICS OF EACH PLANT.



## ARRANGING AND DESIGNING WITH FLOWERS AND DECORATIVE MATERIALS

**UNIT CONCEPT:** DESIGNING INCLUDES A CONSIDERATION OF THE SURROUNDING FOR THE ARRANGEMENTS, AND THE SELECTION OF APPROPRIATE CONTAINERS, FLOWERS, FOLIAGE AND ACCESSORIES. THE BEGINNING FLORAL DESIGNER MUST LEARN THE BASIC PRINCIPLES OF FLOWER ARRANGEMENT AND APPLY THESE TO IDEAS AND MATERIALS IN ORDER TO GIVE A PLEASING EFFECT TO THE FLORAL ARRANGEMENTS.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A VARIETY OF CUT FLOWERS, DECORATIVE PLANT MATERIAL AND ACCESSORIES, AND AN ORDER FOR AN ARRANGEMENT, SELECT THE BASIC DESIGN SHAPE, AN APPROPRIATE CONTAINER AND ARRANGE THE FLOWERS USING APPROVED TECHNIQUES TO THE SATISFACTION OF THE INSTRUCTOR.
2. WHEN GIVEN ADEQUATE PLANT MATERIALS, CONTAINER, AND ACCESSORIES, CONSTRUCT EACH OF THE FOLLOWING ARRANGEMENTS TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER:
  - A. CENTERPIECE
  - B. HOSPITAL ARRANGEMENT
  - C. CORSAGE
  - D. BASKET
  - E. WEDDING BOUQUET

### B. INSTRUCTIONAL AREAS

1. UNDERSTANDING BASIC PRINCIPLES OF FLOWER ARRANGEMENTS
  - A. RECOGNIZING AND UNDERSTANDING THE BASIC DESIGNS AND THEIR ELEMENTS
  - B. DEVELOPING AN UNDERSTANDING OF BALANCE

- C. ATTAINING RHYTHM IN ARRANGEMENTS
- D. SCALE AND PROPORTION IN RELATION TO SIZE OF ARRANGEMENT
- E. LOCATING THE FOCAL POINT OF ARRANGEMENTS
- F. DEVELOPING HARMONY IN ARRANGEMENTS
- G. ACCENTING ARRANGEMENTS BY USING CONTRAST
- H. REPETITION OF FLOWERS FOR ADDING INTEREST IN ARRANGEMENTS
- I. ACHIEVING UNITY IN FLORAL ARRANGEMENTS
- 2. DEVELOPING PROFICIENCY IN MECHANICS OF FLORAL DESIGN
  - A. HOLDING FLOWERS IN PLACE
  - B. STEMMING FLOWERS
  - C. WIRING FLOWERS FOR STABILITY
  - D. CUTTING FLOWERS TO SIZE
  - E. TYING RIBBONS INTO BOWS
  - F. CONDITIONING FLOWERS AFTER CUTTING
- 3. DEVELOPING SKILL IN CONSTRUCTING ARRANGEMENTS
  - A. SELECTING CONTAINERS FOR ARRANGEMENTS
  - B. PREPARING THE CONTAINER ACCORDING TO ARRANGEMENT PLANNED
  - C. SELECTING FLOWERS AND ACCESSORIES NEEDED
  - D. ESTABLISHING THE LINES OF THE ARRANGEMENTS
  - E. ESTABLISHING THE FOCAL POINTS OF THE ARRANGEMENTS
  - F. FILLING IN THE ARRANGEMENT
- 4. DEVELOPING SKILL IN CONSTRUCTING CORSAGES
  - A. WIRING AND TAPING TO BE USED

- B. ADDING THE BACKING OR WATER TUBE
  - C. ASSEMBLING FLOWERS ON CORSAGE
  - D. FINISHING THE CORSAGE WITH FOLIAGE
  - E. PLACING BOWS AND PINS
5. CONSTRUCTING WEDDING BOUQUETS
- A. WIRING AND TAPING FLOWERS TO BE USED
  - B. ASSEMBLING THE UPPER SECTION OF THE BOUQUET
  - C. ASSEMBLING THE MIDDLE AND LOWER SECTIONS OF THE BOUQUET
  - D. INSERTING THE THREE SECTIONS INTO THE STYROFOAM HANDLE TO FORM CRESCENT
  - E. FINISHING WITH RIBBON PUFFS
- C. EXAMPLES OF STUDENT LEARNING ACTIVITIES
- 1. A. HAVE STUDENT PRACTICE WIRING FLOWERS FOR ARRANGEMENTS.
    - B. OBTAIN AN FTD (FLORAL TRANSWORLD DELIVERY) BOOKLET AND OTHER FLORAL DESIGN MAGAZINES FROM A LOCAL FLORIST. CUT OUT THE PICTURES AND GROUP THEM AS TO OCCASION AND MAKE A NOTEBOOK FOR FUTURE REFERENCE.
  - 2. A. HAVE STUDENTS DESIGN AND CONSTRUCT ARRANGEMENTS FOR SCHOOL OFFICES, LIBRARY, ETC. FOR PRACTICE AS WELL AS PUBLIC RELATIONS FOR THE DEPARTMENT.
    - B. IF POSSIBLE, ARRANGE A FIELD TRIP TO A FLORIST SHOP AND HAVE STUDENTS ASSIST WITH DESIGNING OF SOME ARRANGEMENTS. ANOTHER ALTERNATIVE WOULD BE TO HAVE STUDENTS OBSERVE THE PROCESS AND SKETCH THE DESIGNS INCLUDING A LISTING OF FLOWERS AND MATERIALS USED.
    - C. HAVE STUDENTS DRAW A DESIGN SHOWING BALANCE, FOCAL POINTS, AND INDICATE PLANT MATERIALS TO BE USED. AN ESTIMATE OF COST SHOULD ALSO BE INCLUDED.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. HAVE EACH STUDENT LIST THE NINE BASIC PRINCIPLES OF FLOWER ARRANGING AND GIVE A SHORT DEFINITION OF EACH ONE. THIS LIST SHOULD INCLUDE DESIGN, BALANCE, SCALE, HARMONY, FOCAL POINT, ACCENT, RHYTHM, REPETITION, AND UNITY.
2. GIVE EACH STUDENT AN ORDER FOR AN ARRANGEMENT, AND HAVE THEM SELECT AN APPROPRIATE CONTAINER AND FLORAL MATERIALS, AND THEN CONSTRUCT AN ARRANGEMENT WHICH WILL MEET THE REQUIREMENTS OF THE ORDER AND BE SATISFACTORY TO THE INSTRUCTOR OR EMPLOYER IF ON PLACEMENT.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. VARIOUS TYPES CONTAINERS FOR ARRANGING
2. VARIOUS TYPES AND STYLES OF RIBBON
3. FLORATAPE
4. COMMON HOLDING DEVICES
5. FLORAL WIRE
6. NETTING
7. VARIETY OF FLORAL MATERIAL (FLOWERS)

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. BEGINNING TECHNIQUES IN FLOWER ARRANGING. SAN LUIS OBISPO, CALIFORNIA: VOCATIONAL EDUCATION PRODUCTIONS, CALIFORNIA POLYTECHNIC STATE UNIVERSITY.

THIS IS A FILMSTRIP MANUAL WHICH GIVES AN EXCELLENT OVERVIEW AND PROCEDURE FOR BEGINNERS IN FLOWER ARRANGING.

2. RETAIL FLOWER SHOP OPERATION AND MANAGEMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: AGRICULTURAL EDUCATION DEPARTMENT, UNIVERSITY OF PENNSYLVANIA. PP. 53-109.

AN EXCELLENT REFERENCE FOR STUDYING TECHNIQUE OF DESIGN AND THE PROCESS FOR CONSTRUCTING VARIOUS ARRANGEMENTS. INCLUDES MANY PHOTOGRAPHS AND DRAWINGS WHICH ARE QUITE HELPFUL TO ACCOMPLISH THE OBJECTIVES.

## IV

LANDSCAPE MAINTENANCE AND ESTABLISHMENT  
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LANDSCAPE SITE PREPARATION

PLANTING LANDSCAPE PLANTS AND TREES

WATERING AND WEED CONTROL OF LANDSCAPE PLANTS

FERTILIZING ESTABLISHED LANDSCAPE PLANTS AND TREES

LANDSCAPE INSECT AND DISEASE CONTROL

PRUNING LANDSCAPE PLANTS AND TREES

## LANDSCAPE SITE PREPARATION

**UNIT CONCEPT:** PROPER SITE PREPARATION AND PLACEMENT OF STRUCTURAL MATERIALS BY A LANDSCAPE WORKER ACCORDING TO THE LANDSCAPE PLANS WILL RESULT IN A SITE PREPARED AS THE DESIGNER INTENDED.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A SPECIFIC SITE TO BE LANDSCAPED, USE HAND TOOLS TO GRADE AND DRAIN THE SITE, ACCORDING TO THE LANDSCAPE PLANS AND TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER.
2. WHEN GIVEN A SITE TO LANDSCAPE, DEMONSTRATE THE PROCEDURE(S) FOR COLLECTING A REPRESENTATIVE SOIL SAMPLE, PREPARING IT FOR ANALYSIS, AND INTERPRETING THE RESULTS AFTER ANALYSIS.
3. WHEN GIVEN SPECIFIC LANDSCAPE PLANS, CONSTRUCT WALLS, PATIOS, WALKS AND/OR OTHER STRUCTURES, ACCORDING TO RECOMMENDED PROCEDURES AND TO THE SATISFACTION OF THE INSTRUCTOR.

### B. INSTRUCTIONAL AREAS

1. ANALYZING AND PREPARING THE LANDSCAPE AREA
  - A. READING THE BLUEPRINT
  - B. LAYING OUT THE LANDSCAPE PLAN
  - C. DEVELOPING A WORKING SITE PLAN
  - D. GRADING THE SITE
  - E. DETERMINING DRAINAGE NEEDS
  - F. INSTALLING DRAINAGE SYSTEMS
2. PREPARING THE LANDSCAPE SITE FOR PLANTING
  - A. PROCEDURES FOR COLLECTING REPRESENTATIVE SOIL SAMPLES

- B. PREPARING SOIL SAMPLES FOR ANALYSIS AT RECOGNIZED LABORATORY
- C. ANALYZING AND INTERPRETING SOIL TEST RESULTS
- D. APPLYING RECOMMENDED LIME AND FERTILIZERS
- E. ACQUIRING NEEDED LANDSCAPE AND NURSERY PLANTS
- 3. PLANTING LANDSCAPE PLANTS AND TURF
  - A. PREPARING HOLES FOR SHRUBS AND TREES
  - B. PLANTING TREES AND SHRUBS
  - C. SEEDING TURF AREAS
- 4. CONSTRUCTING LANDSCAPE STRUCTURE
  - A. LAYING OUT AND INSTALLING WALKS, DRIVES AND PATIOS
  - B. RETAINING WALLS
  - C. FREE STANDING WALLS
  - D. CONSTRUCTING FENCES
  - E. STEPS AND RAMPS CONSTRUCTION
  - F. INSTALLING FOUNTAINS OR OTHER WATER STRUCTURES

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. GIVE STUDENTS TOPOGRAPHIC MAPS AND BLUEPRINTS AND HAVE THEM DETERMINE WHAT GRADING CAN BE DONE WITH HAND TOOLS TO PROVIDE MORE ADEQUATE DRAINAGE.
- 2. A. COLLECT SOIL SAMPLES AROUND THE LANDSCAPING OF SCHOOLS AND MODIFY THE SOIL, ACCORDING TO SOIL TEST ANALYSES.  
  
B. VISIT A LANDSCAPE DESIGNER AND DISCUSS THE CONCEPTS TO CONSIDER IN DESIGNING A LANDSCAPE PLAN. UPON RETURN TO THE CLASSROOM, HAVE STUDENTS DEVELOP PLANS FOR SPECIFIC AREAS.
- 3. A. HAVE STUDENTS PRACTICE LAYING OUT WALKS, PATIOS AND OTHER STRUCTURES THAT MAY BE NEEDED IN LANDSCAPE AREAS.  
  
B. STUDENTS SHOULD PRACTICE MIXING CONCRETE FOR VARIOUS LANDSCAPE STRUCTURES SUCH AS WALKS, WALLS AND OTHER STRUCTURES.



#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING PICTURES OR DRAWINGS SHOWING GRADED LANDSCAPE AREAS, EACH STUDENT SHOULD BE ABLE TO DISTINGUISH ORALLY OR IN WRITING THE AREAS WHICH APPEAR TO BE GRADED PROPERLY IN ORDER TO ACHIEVE ADEQUATE DRAINAGE.
2. EACH STUDENT SHOULD BE ABLE TO LIST THE IMPORTANT FACTORS TO CONSIDER WHEN ATTEMPTING TO COLLECT AND PREPARE A REPRESENTATIVE SOIL SAMPLE FOR ANALYSIS. THIS LIST OF FACTORS SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) SELECTING PROPER EQUIPMENT, I.E., AUGER, (2) SURVEYING SITE FOR UNIQUE SOIL TYPE AREAS, (3) COLLECTING SAMPLES FROM REPRESENTATIVE SECTIONS OF FIELDS, (4) MIXING SAMPLES FOR REPRESENTATIVENESS, AND (5) MAKING SURE INFORMATION SHEETS ARE COMPLETE BEFORE SENDING SAMPLES TO THE LABORATORY.
3. EACH STUDENT SHOULD BE ABLE TO DEMONSTRATE THE PROPER PROCEDURE FOR MIXING CONCRETE WHICH MIGHT BE USED TO CONSTRUCT A WALK IN A PLANNED LANDSCAPE SITE. THIS "MIX" SHOULD BE EVALUATED ON THE BASIS OF RECOMMENDED PROCEDURES AND TO THE SATISFACTION OF THE INSTRUCTOR.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. SOIL PROBE
2. FERTILIZER, PEAT MOSS AND MULCH
3. TAPE, SPIRIT LEVEL
4. HAND TOOLS --- SPADES, RAKES, HOES
5. WHEELBARROW
6. CONSTRUCTION MATERIALS FOR LANDSCAPE STRUCTURES

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. HANDBOOK ON GARDEN CONSTRUCTION. BROOKLYN, NEW YORK: BROOKLYN BOTANIC GARDEN.

A PUBLICATION WHICH DEALS COMPREHENSIVELY WITH THE "HOW-TO" FOR CONSTRUCTING WALKWAYS, PATIOS, WATER STRUCTURES AND VARIOUS OTHER STRUCTURES NEEDED IN LANDSCAPE PLANS AND DESIGNS.

2. LANDSCAPE MAINTENANCE AND ESTABLISHMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 33-46.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THEIR RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT.

## PLANTING LANDSCAPE PLANTS AND TREES

**UNIT CONCEPT:** PROPER PLANTING OF LANDSCAPE PLANTS AND TREES BY THE LANDSCAPE WORKER PROVIDES PLANTS THAT WILL GROW AND DEVELOP AS THEY WERE INTENDED.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A LANDSCAPE PLAN AND VARIOUS TYPES OF PLANTS WHICH ARE BAREROOT, BALLED AND BURLAPPED, AND CONTAINER-GROWN STOCK, TRANSPLANT THE PLANTS USING THE RECOMMENDED PROCEDURES AND PRACTICES.
2. WHEN GIVEN TREES NEEDING PROTECTION FROM WINTER WINDS AND TEMPERATURES, PROPERLY WRAP AND STAKE THE TREES ACCORDING TO INDUSTRY STANDARDS.
3. WHEN GIVEN NEWLY PLANTED LANDSCAPE PLANTS AND TREES, DEMONSTRATE THE RECOMMENDED METHOD OF WATERING NEWLY PLANTED STOCK.
4. WHEN GIVEN AN ORGANIC MULCH MATERIAL AND SUFFICIENT HAND TOOLS, APPLY A MULCH TO THE LANDSCAPE PLANTINGS TO CONSERVE MOISTURE, MAINTAIN AN EVEN SOIL TEMPERATURE, AND ADD TO THE BEAUTY OF THE LANDSCAPE.

### B. INSTRUCTIONAL AREAS

#### 1. TRANSPLANTING TREES

- A. DETERMINING TIME FOR TRANSPLANTING
- B. PREPARING THE HOLE FOR TRANSPLANTING
  - (1) DETERMINING PROPER DEPTH
  - (2) DETERMINING PROPER WIDTH
- C. PRUNING ROOTS OF BAREROOT PLANTS
- D. REMOVING OR LOOSENING BURLAP
- E. SETTING THE TREE IN HOLE

- F. REPACKING THE SOIL
- G. FERTILIZING AND WATERING
- H. PRUNING THE NEWLY PLANTED TREE
- 2. WRAPPING AND STAKING TREES
  - A. IDENTIFYING TREES REQUIRING WRAPPING
  - B. SELECTING WRAPPING MATERIAL
  - C. WRAPPING THE TREE
  - D. SELECTING THE METHOD OF SUPPORTING THE TREE
  - E. STAKING THE TREE FOR SUPPORT
- 3. TRANSPLANTING SHRUBS
  - A. CARING FOR BARERoot, BALLED AND BURLAPPED AND CONTAINER-GROWN STOCK
  - B. DETERMINING TIME FOR TRANSPLANTING
  - C. DETERMINING PROPER SPACING
  - D. PREPARING HOLE FOR TRANSPLANTING
  - E. REPACKING SOIL AROUND SHRUB
  - F. FERTILIZING AND WATERING
  - G. PRUNING
  - H. PROTECTING SHRUBS FROM WATER LOSS
- 4. PLANTING GROUND COVERS, VINES, ESPALIERS AND HERBACEOUS PLANTS
  - A. DETERMINING SPACING AND DEPTH OF PLANTING
  - B. DETERMINING PLANTING DATES
  - C. PREPARING SEEDBED
  - D. FERTILIZING AND WATERING
  - E. DETERMINING METHODS AND TECHNIQUES OF SUPPORTING PLANTS

## 5. MULCHING LANDSCAPE PLANTS AND TREES

### A. DETERMINING PURPOSE OF MULCHING

### B. SELECTING THE PROPER MULCH

### C. APPLYING MULCHES

(1) DETERMINING TIME TO APPLY

(2) DETERMINING DEPTH OF MULCH NEEDED

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. HAVE STUDENTS TRANSPLANT VARIOUS TYPES OF PLANTS WHICH ARE BARERoot, BALLED AND BURLAPPED, AND CONTAINER-GROWN STOCK. THIS COULD BE DONE TO BEAUTIFY THE SCHOOL GROUNDS AS A PROJECT OF THE FFA CHAPTER OR IN COOPERATION WITH OTHER SCHOOL OR COMMUNITY GROUPS.
2. A. HAVE STUDENTS MAKE CHARTS, OR TRANSPARENCIES OF THE PROPER PLANTING, STAKING, AND WRAPPING OPERATIONS FOR USE IN CLASS AND FOR GIVING DEMONSTRATIONS TO OTHER CLASSES OR GROUPS.  
  
B. HAVE STUDENTS WRAP, AND STAKE NEWLY PLANTED TREES AND SHRUBS.
3. HAVE STUDENTS PRACTICE PROPER PROCEDURES FOR WATERING TRANSPLANTED TREES AND SHRUBS.
4. IDENTIFY USES OF DIFFERENT TYPES OF MULCHES FOR LANDSCAPING; APPLY A NUMBER OF THE DIFFERENT MULCHES AND HAVE STUDENT CONSIDER EACH FOR DESIRABILITY, BEAUTY AND EFFECTIVENESS.

## D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. HAVE EACH STUDENT LIST THE PROCEDURES TO FOLLOW FOR PROPERLY TRANSPLANTING BALLED AND BURLAPPED TREES AND SHRUBS. THE LISTING MUST INCLUDE TIME OF PLANTING, PROCEDURE FOR SETTING TREE IN PREPARED HOLE, PACKING THE SOIL, FERTILIZING AND WATERING, PRUNING, WRAPPING AND STAKING.
2. GIVE STUDENTS DRAWINGS OR PICTURES OF WRAPPED AND STAKED TREES, SOME OF WHICH ARE PROPERLY DONE AND OTHERS THAT ARE NOT, AND HAVE STUDENTS INDICATE THOSE WHICH ARE DONE SATISFACTORILY. FOR THOSE THAT ARE NOT, STUDENTS MUST DESCRIBE CORRECTIVE PROCEDURES IN ORDER FOR THEM TO MEET INDUSTRY STANDARDS.

3. USING PICTURES OF RECENTLY WATERED TREES OR SHRUBS, HAVE STUDENTS INDICATE THOSE THAT HAVE NOT RECEIVED SUFFICIENT WATER, THOSE THAT ARE PROPERLY WATERED, AND THOSE THAT ARE "OVER-WATERED" WITH COMPLETE ACCURACY.
4. THE STUDENT SHOULD LIST THE FACTORS TO CONSIDER WHEN SELECTING MATERIALS FOR MULCHING PURPOSES. THIS LIST MUST INCLUDE THE FOLLOWING: (1) AVAILABILITY, (2) COST COMPARISONS, (3) APPEARANCE, (4) DURABILITY, (5) RATE OF DECOMPOSITION, (6) POSSIBILITY OF PRODUCING WEED SEED, (7) DANGER OF INTRODUCING DISEASES, AND (8) POSSIBILITY OF FIRE.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. SEVERAL TREES AND SHRUBS READY FOR TRANSPLANTING
2. STRAW, SAWDUST, PEAT AND WOOD CHIPS TO USE AS MULCHES
3. STAKES, WRAPPING, STRING, HOSE AND WIRE FOR GUYING TREES
4. SHOVELS FOR PLANTING SPECIMENS

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. LANDSCAPE MAINTENANCE AND ESTABLISHMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 24 AND 47-56.

THIS IS ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE WHICH IS DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THEIR RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT.

2. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 207-216 AND 231-234.

PART II OF A TWO-VOLUME SET OF REFERENCE MATERIALS FOR A NURSERY WORKER COURSE OF STUDY. MATERIAL COVERED IN PART II DEALS WITH NURSERY PRACTICES INCLUDING METHODS OF PLANT PROPAGATION, FIELD PRACTICES, PEST CONTROL, MARKETING AND RECORD KEEPING. THE SECTION ON TRANSPLANTING, STAKING AND PRUNING IS ESPECIALLY USEFUL FOR ACCOMPLISHING THE OBJECTIVES OF THIS UNIT.

## WATERING AND WEED CONTROL OF LANDSCAPE PLANTS

**UNIT CONCEPT:** CAREFUL WATERING IS NECESSARY FOR THE ESTABLISHMENT OF LANDSCAPE PLANTS AND TO KEEP THEM GROWING DURING DRY PERIODS. WEEDS ALSO COMPETE FOR LIGHT, NUTRIENTS AND WATER WITH LANDSCAPE PLANTS, IT IS, THEREFORE, NECESSARY FOR THE LANDSCAPER TO PROVIDE ADEQUATE WATER FOR THE ESTABLISHMENT OF PLANTS. LIKEWISE, THE LANDSCAPE WORKER MUST EFFECTIVELY CARRY OUT A WEED CONTROL PROGRAM TO ASSURE PRODUCTIVE GROWTH OF LANDSCAPE PLANTS.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT WILL BE ABLE TO:

1. WHEN GIVEN VARIOUS TYPES OF WATERING EQUIPMENT AND LANDSCAPE PLANTS, SELECT THE MOST APPROPRIATE EQUIPMENT TO USE TO SUPPLY THE MOISTURE NEEDS OF THE AREA, ACCORDING TO PLANTS NEEDS AND INDUSTRY RECOMMENDATIONS.
2. WHEN GIVEN A SPECIFIC TYPE OF LANDSCAPE PLANTING, DETERMINE THE AMOUNT AND FREQUENCY OF WATERING NEEDED TO PROVIDE THE NECESSARY MOISTURE FOR PRODUCTIVE GROWTH.
3. WHEN GIVEN A SITUATION OF WEED INFESTATION OF A LANDSCAPED AREA, RECOGNIZE THE PROBLEM AND CARRY OUT THE APPROPRIATE CHEMICAL, CULTURAL AND/OR MECHANICAL PROCEDURES NECESSARY FOR CONTROLLING WEEDS.
4. WHEN GIVEN CHEMICAL WEED CONTROL SPRAYERS, DEMONSTRATE THE ABILITY TO PROPERLY MIX AND APPLY THE SPRAY MATERIAL AND CLEAN THE EQUIPMENT FOR STORAGE, ACCORDING TO INDUSTRY RECOMMENDATIONS.

### B. INSTRUCTIONAL AREAS

#### 1. SELECTING WATERING EQUIPMENT

##### A. TYPES OF WATERING EQUIPMENT

- (1) SPRINKLER TYPES AND STYLES
- (2) PERMANENT IRRIGATION LAYOUTS

##### B. DETERMINING AMOUNT OF WATER NEEDED BY VARIOUS PLANTS



- C. DETERMINING FREQUENCY OF WATERING
  - D. DETERMINING COST OF WATERING EQUIPMENT (ECONOMICS OF SELECTION)
  - E. PERFORMING NECESSARY MAINTENANCE REQUIRED FOR VARIOUS TYPES OF EQUIPMENT
2. DETERMINING AMOUNT OF WATER TO APPLY
- A. WATER CAPACITY OF SOIL AND RELATION TO WILTING POINT
  - B. DETERMINING AMOUNT OF WATER AVAILABLE BY SOIL TEXTURE AND WATER GAUGE
  - C. RELATIONSHIP OF IRRIGATION AND FERTILIZER
3. DETERMINING FREQUENCY OF WATERING BY SOIL TYPE AND CLIMATIC CONDITIONS
- A. USING CHARACTERISTICS OF SOIL TYPES AS RELATED TO WATER-HOLDING CAPACITY TO DETERMINE FREQUENCY
    - (1) TEXTURE
    - (2) INTERNAL DRAINAGE
    - (3) PERMEABILITY
    - (4) SURFACE RUNOFF
  - B. DETERMINING CLIMATIC CONDITIONS WHICH MAY AFFECT FREQUENCY
    - (1) TRANSPIRATION
    - (2) HUMIDITY
    - (3) EVAPORATION
    - (4) RAINFALL (AMOUNT AND FREQUENCY)
4. DETERMINING UNDESIRABLE EFFECTS OF WEEDS
- A. DETERMINING CONTROL EXPENSE
  - B. HARBORING OF PLANT INSECTS AND DISEASES
  - C. EFFECTS ON BEAUTY OF LANDSCAPE
  - D. COMPETITION FOR LIGHT, MOISTURE AND NUTRIENTS
5. IDENTIFYING WEED CHARACTERISTICS AFFECTING CONTROL
- A. LIFE STYLE (ANNUAL, PERENNIAL, BIENNIAL)
  - B. WEED IDENTIFICATION
  - C. REPRODUCTIVE SYSTEM

## 6. SELECTING METHODS OF WEED CONTROL

### A. USING MECHANICAL METHODS FOR WEED CONTROL

### B. IDENTIFYING AND USING BIOLOGICAL METHODS

### C. USING CHEMICAL CONTROL METHODS

- (1) DETERMINING TIME OF APPLICATION
- (2) SELECTING METHOD OF APPLICATION AND EQUIPMENT
- (3) MIXING SPRAY MATERIAL AND RATE OF APPLICATION
- (4) SAFETY PRECAUTIONS TO OBSERVE
- (5) OPERATING THE EQUIPMENT
- (6) CLEANING AND STORING APPLICATION EQUIPMENT

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. USING PICTURES OR ACTUAL WATERING EQUIPMENT (SPRINKLERS), HAVE STUDENTS SELECT THOSE MOST APPROPRIATE FOR SPECIFIC LANDSCAPE AREAS.
2. STUDY VARIOUS SOIL TYPES AND TEXTURES TO DETERMINE THE WATER-HOLDING CAPACITY OF THE SOIL IN AN EFFORT TO DETERMINE FREQUENCY OF WATERING.
3. A. USING LABELS FROM HERBICIDES, HAVE STUDENTS IDENTIFY THEIR USE AS PRE-PLANT, PRE-EMERGENCE, OR POST-EMERGENCE SPRAY AND IDENTIFY THE LANDSCAPE WITH WHICH THEY CAN BE USED.  
  
B. USING LIVE OR DRIED SPECIMENS OF WEEDS COMMON TO THE AREA, HAVE STUDENTS IDENTIFY THE WEEDS AND USE REFERENCES TO CITE THE CONTROL MEASURES TO USE.
4. A. USING LABELS FROM HERBICIDES, HAVE STUDENTS LIST SAFETY PRECAUTIONS TO OBSERVE DURING AND AFTER APPLICATION.  
  
B. MIX AND APPLY THE NEEDED SPRAY MATERIAL TO THE LANDSCAPE PLANTINGS ON THE SCHOOL GROUNDS AND CLEAN THE EQUIPMENT AFTERWARD.

## D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. A. USING PICTURES, SLIDES OR OTHER VISUALS OF VARIOUS TYPES OF WATERING EQUIPMENT, HAVE STUDENTS IDENTIFY EACH WITH COMPLETE ACCURACY. THESE SHOULD BE TYPES OF EQUIPMENT COMMONLY USED IN THE LOCAL AREA.

B. HAVE STUDENTS LABEL VARIOUS DRAWINGS OF WATERING EQUIPMENT SUCH AS NOZZLES, HOSES AND LUBRICATION POINTS WITH COMPLETE ACCURACY.

2. EACH STUDENT SHOULD LIST AND EXPLAIN THE SOIL CHARACTERISTICS WHICH AFFECT THE WATER-HOLDING CAPACITY OF VARIOUS SOIL TYPES. THIS LIST SHOULD INCLUDE: (1) TEXTURE, (2) INTERNAL DRAINAGE, (3) PERMEABILITY AND (4) SURFACE RUNOFF.
3. DEVELOP A MATCHING TEST USING PICTURES OF LANDSCAPE AREAS INFESTED WITH WEEDS AND HAVE STUDENTS MATCH WITH WEED(S) CAUSING DAMAGE. THEY COULD ALSO MATCH WEEDS WITH RECOMMENDED CONTROL METHODS. COMPLETE ACCURACY IS NECESSARY.
4. EACH STUDENT SHOULD LIST OR EXPLAIN THE PROCEDURE FOR CALIBRATING A SPRAYER OR APPLICATOR FOR APPLYING HERBICIDES TO LANDSCAPE AREAS WITH COMPLETE ACCURACY. IF POSSIBLE, THIS SHOULD BE CARRIED TO THE "FIELD" AND DEMONSTRATED ON ACTUAL LANDSCAPE PLANTS AND AREAS.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. VARIOUS TYPES OF IRRIGATION EQUIPMENT (SPRINKLERS)
2. SOIL PROFILES FOR STUDYING SOIL TYPES AND CHARACTERISTICS
3. HERBICIDE CONTAINER LABELS AND HERBICIDES
4. HAND SPRAYERS
5. WEED SPECIMENS (LIVE AND/OR DRIED)

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. LANDSCAPE MAINTENANCE AND ESTABLISHMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 24-25.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THEIR RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT.

2. WEED CONTROL --- CULTURAL AND CHEMICAL. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1969, 111 PAGES.

AN EXCELLENT PUBLICATION WHICH DESCRIBES THE VARIOUS METHODS OF WEED CONTROL, PROCEDURES FOR CHEMICAL AND CULTURAL CONTROL, AND SAFETY PRECAUTIONS FOR MIXING, APPLYING AND STORING OF CHEMICALS USED FOR CONTROL.

## FERTILIZING ESTABLISHED LANDSCAPE PLANTS AND TREES

**UNIT CONCEPT:** TO MAINTAIN ADEQUATE NUTRIENTS FOR PLANT GROWTH, IT IS NECESSARY THAT THE LANDSCAPE WORKER BE ABLE TO MAKE SOIL TESTS AND CARRY OUT THE NECESSARY FERTILIZATION TO ACHIEVE OPTIMUM GROWTH.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO: .

1. WHEN GIVEN A SITE WITH ESTABLISHED LANDSCAPE PLANTS AND TREES, DEMONSTRATE THE PROPER METHOD OF SELECTING A SOIL SAMPLE AND DETERMINE THE NEED FOR FERTILIZATION BY INTERPRETING THE SOIL TEST RESULTS.
2. WHEN GIVEN SEVERAL FIXED ANALYSIS FERTILIZERS, DETERMINE THE POUNDS OF ACTUAL PLANT FOOD IN EACH WITHIN  $\pm$  ONE POUND.
3. WHEN GIVEN LANDSCAPE PLANTS EXHIBITING UNDERSIZED OR YELLOW LEAVES, SPARSE FOLIAGE, OR LITTLE TWIG GROWTH, DETERMINE THE FERTILITY NEEDS OF THE PLANTS.
4. WHEN GIVEN LIQUID AND GRANULAR FERTILIZER APPLICATORS, CALIBRATE AND APPLY THE NEEDED MATERIALS TO THE LANDSCAPE PLANTS AND PREPARE THE EQUIPMENT FOR STORAGE FOLLOWING USE.

### B. INSTRUCTIONAL AREAS

1. TAKING A SOIL SAMPLE
  - A. SELECTING AND ACQUIRING EQUIPMENT NEEDED
  - B. PROCEDURES FOR COLLECTING A REPRESENTATIVE SAMPLE
  - C. DETERMINING TIME OF YEAR FOR SAMPLING
  - D. PREPARING THE SAMPLE FOR LABORATORY ANALYSIS
  - E. FILLING IN FORMS FOR SENDING SAMPLES TO TESTING LABORATORIES.
2. INTERPRETING SOIL TEST RESULTS

- A. DETERMINING AMOUNT OF APPLICATION NEEDED
- B. DETERMINING RECOMMENDED ANALYSIS NEEDED FOR IMPROVEMENT
- C. DETERMINING TIME OF YEAR FOR MOST EFFECTIVE APPLICATION
- 3. SELECTING AND PURCHASING FERTILIZING AND LIME
  - A. DETERMINING NUTRIENT NEEDS OF TREES FOR PRODUCTIVE GROWTH
  - B. RECOGNIZING AND SELECTING RECOMMENDED FERTILIZER ACCORDING TO FORM AND CHARACTERISTICS
  - C. DETERMINING FERTILIZER RATIOS
  - D. SELECTING FOR NUTRIENT AVAILABILITY
  - E. PURCHASING ECONOMICS OF FERTILIZERS
- 4. APPLYING FERTILIZERS AND LIME TO LANDSCAPE AREAS
  - A. METHODS OF APPLYING DRY FERTILIZERS
  - B. METHODS OF APPLYING LIQUID FERTILIZERS
  - C. DETERMINING EFFECTIVENESS OF VARIOUS METHODS OF APPLICATION
  - D. IDENTIFYING TYPES OF SPREADERS AND APPLICATORS
  - E. CALIBRATING SPREADERS AND APPLICATORS
  - F. CLEANING PROCEDURES AND LUBRICATION

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. A. HAVE STUDENTS SAMPLE SOIL AROUND ESTABLISHED LANDSCAPE PLANTS AND TREES AND SEND TO AN ESTABLISHED LABORATORY FOR ANALYSIS. STUDENTS CAN THEN REVIEW AND INTERPRET RECOMMENDATIONS AFTER RESULTS ARE RETURNED.
- B. HAVE STUDENTS SAMPLE HOME OWNERS SOIL AROUND TREES AND SHRUBS AND SEND THEM TO A LABORATORY FOR TESTING. THIS IS A GOOD PUBLIC RELATIONS TOOL FOR THE DEPARTMENT. IT SHOULD BE NOTED THAT THE HOME OWNER MUST BEAR THE COST OF MAILING AND TESTING.
- C. VISIT A SOIL TESTING LABORATORY IF ONE IS NEARBY, AND LET STUDENTS OBSERVE AND SUMMARIZE THE PROCEDURE(S) USED TO ANALYZE SOIL SAMPLES IN A CLASS REPORT.

2. A. WITH SEVERAL FERTILIZER BAGS, HAVE THE STUDENTS STUDY INFORMATION ON THE BAG. THEY SHOULD STUDY SUCH ITEMS AS ANALYSIS, POUNDS OF NUTRIENTS, CONTENTS AND INFORMATION ON PROPER APPLICATION AND BE ABLE TO DESCRIBE WHAT THE INFORMATION MEANS.  
  
B. IF POSSIBLE, VISIT A FERTILIZER PLANT AND ASSIGN GROUPS OF STUDENTS TO PREPARE CLASS PRESENTATIONS ON THE VARIOUS STEPS OF THE PROCESS.
3. HAVE STUDENTS DEVELOP A SET OF SLIDES SHOWING TREES WITH VARIOUS NUTRIENT DEFICIENCIES AND THEN HAVE STUDENTS DESCRIBE WHAT TYPE OF FERTILIZER(S) AS NEEDED TO CORRECT THESE DEFICIENCIES.
4. STUDENTS SHOULD CALIBRATE VARIOUS TYPES OF SPREADERS FOR VARIOUS RATES OF APPLICATION.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. GIVE STUDENTS "EXAMPLE" TREES WHICH SHOW NUTRIENT DEFICIENCIES AND HAVE STUDENTS LIST THE STEPS ONE MUST FOLLOW TO DETERMINE WHAT LEVEL OF FERTILIZATION IS NEEDED TO CORRECT THE DEFICIENCY. THIS LIST SHOULD INCLUDE SOIL SAMPLING, SENDING TO LABORATORY FOR ANALYSIS, INTERPRETING ANALYSIS INFORMATION, AND SELECTING FERTILIZER(S) NEEDED.
2. USING FERTILIZER BAG LABELS, HAVE STUDENTS FIGURE THE POUNDS OF ACTUAL PLANT FOOD IN EACH WITHIN  $\pm$  ONE POUND.
3. USE SLIDES, PICTURES, OR LEAF SAMPLES SHOWING NUTRIENT DEFICIENCIES AND HAVE STUDENTS MATCH EACH OF THESE TO A LIST OF NUTRIENTS (FERTILIZERS) WHICH WILL CORRECT THE DEFICIENCIES WITH 95% ACCURACY.
4. EACH STUDENT SHOULD LIST OR EXPLAIN THE PROCEDURES FOR CALIBRATING A FERTILIZER APPLICATOR WITH COMPLETE ACCURACY. IF POSSIBLE, THIS SHOULD BE CARRIED TO THE "FIELD" AND DEMONSTRATED WITH ACTUAL TREES.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. FERTILIZERS OF VARYING ANALYSES INCLUDING MICRONUTRIENTS
2. LIQUID APPLICATORS
3. FERTILIZER BAGS FOR LABEL INFORMATION ANALYSIS ACTIVITY



4. SOIL TESTING MAILING KITS (THESE CAN BE ACQUIRED IN A COUNTY EXTENSION OFFICE IN YOUR AREA)
5. SOIL AUGER

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. LANDSCAPE MAINTENANCE AND ESTABLISHMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: THE PENNSYLVANIA STATE UNIVERISTY. 1968, PP. 12-17.

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## LANDSCAPE INSECT AND DISEASE CONTROL

**UNIT CONCEPT:** INSECTS, DISEASES AND PESTS OF LANDSCAPE PLANTS CAN BE CONTROLLED IF CERTAIN FACTORS ARE CONSIDERED AND PROPER PROCEDURES ARE FOLLOWED BY THE LANDSCAPE WORKER.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. GIVEN TEN LANDSCAPE PLANT SPECIMENS DAMAGED BY DISEASE, INSECTS OR PESTS, RECOGNIZE THE SOURCE OF THE DAMAGE, EITHER ON SIGHT OR USING A RECOGNIZED REFERENCE.
2. GIVEN A RECOGNIZED REFERENCE AND LANDSCAPE PLANT SPECIMENS, DETERMINE RECOMMENDATIONS FOR CONTROL OF CERTAIN PESTS.
3. WHEN GIVEN VARIOUS LANDSCAPE PLANT SPECIMENS WITH DISEASE OR INSECT DAMAGE, CARRY OUT RECOMMENDED PROCEDURES FOR CONTROLLING SPECIFIC PLANT PEST PROBLEMS.
4. GIVEN A LANDSCAPED AREA, IMPLEMENT A PREVENTATIVE PROGRAM FOR PEST CONTROL.

### B. INSTRUCTIONAL AREAS

1. IDENTIFYING THE INSECT LIFE CYCLES AS RELATED TO CONTROL
  - A. SELECTING THE GROWTH STAGE FOR EASIEST CONTROL
  - B. SELECTING THE EFFECTIVE CONTROL SEASON
    - (1) MID-SEASON
    - (2) WINTER SEASON
  - C. LOCATING INSECTS DURING GROWTH STAGES
    - (1) FOLIAGE
    - (2) BARK
    - (3) SOIL
2. SELECTING CONTROL MEASURES

- A. IDENTIFICATION OF INSECTS CAUSING DAMAGE
  - B. PRESCRIBING EFFECTIVE CONTROL - SEE REFERENCE SECTION FOR SUGGESTIONS
  - C. APPLYING EFFECTIVE CONTROL PROCEDURES
    - (1) LEGAL IMPLICATIONS FOR MISUSE OF CHEMICALS
    - (2) FOLLOWING SAFE PROCEDURES
3. DETERMINING SOURCES OF PLANT DISEASES
- A. BACTERIA
  - B. FUNGI
  - C. VIRUSES
  - D. MYCOPLASMA
  - E. NEMATODES
  - F. NON-PATHOGENIC DISEASES
4. SELECTING METHODS OF PLANT DISEASE CONTROL
- A. MECHANICAL CONTROL - KILLING INSECTS BY HAND, PRUNING
  - B. QUARANTINE CONTROL - RESTRICTING THE SPREAD OF INFESTED OR INFECTED PLANT MATERIAL
  - C. BIOLOGICAL CONTROL - ONE ORGANISM KILLING ANOTHER
  - D. CHEMICAL CONTROL - APPLYING TOXIC CHEMICALS
  - E. NATURAL CONTROL - ADVERSE WEATHER
5. IDENTIFYING TYPES OF DAMAGE TO LANDSCAPE PLANTS BY RODENTS, WILDLIFE AND OTHER PESTS
- A. BARK DAMAGE
  - B. ROOT DAMAGE
  - C. LIMB DAMAGE
6. CONTROLLING RODENTS, WILDLIFE, AND OTHER PEST DAMAGE
- A. FENCING LANDSCAPE AREAS
  - B. BAITS FOR RODENTS

C. BARK REPELLENTS

D. TREATING WOUND DAMAGE

C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. USING REFERENCES THAT DESCRIBE DISEASES IN THE LOCAL AREA, STUDENTS SHOULD IDENTIFY THE CAUSE AND RECOMMEND CONTROL MEASURES FOR VARIOUS PLANT SPECIMENS OR SLIDES OF DISEASED NURSERY PLANTS.
2. STUDENTS SHOULD STUDY THE LIFE CYCLE OF COMMON INSECT PESTS FOUND IN NURSERIES TO DETERMINE THE BEST TIME AND METHOD OF CONTROL.
3. GIVE STUDENTS SPECIFIC PLANT INSECT AND DISEASE "PROBLEMS" AND HAVE THEM USE REFERENCES TO DETERMINE THE MOST APPROPRIATE CONTROL PROCEDURES AND THE PROCEDURES FOR CARRYING OUT THE RECOMMENDATIONS.
4. STUDENTS MAY SET UP A PREVENTIVE CONTROL PROGRAM FOR DISEASES, INSECTS AND OTHER PESTS FOR THE SCHOOL OR COOPERATIVE WORK EXPERIENCE STATION USING RECOGNIZED REFERENCES.

D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. DEVELOP A MATCHING TEST AND HAVE STUDENTS MATCH NAMES OF INSECTS OR DISEASES OF LANDSCAPE AREAS OR PLANTS WITH PICTURES OR SLIDES OF DAMAGED AREAS. THIS EXERCISE SHOULD BE DONE WITH COMPLETE ACCURACY.
2. GIVE STUDENTS SUFFICIENT REFERENCES AND VARIOUS LANDSCAPE SPECIMENS DAMAGED BY INSECTS OR DISEASES AND HAVE EACH STUDENT TO DETERMINE THE MOST APPROPRIATE METHOD OF CONTROL FOR EACH WITH COMPLETE ACCURACY.
3. EACH STUDENT SHOULD LIST AND EXPLAIN THE SAFETY PRECAUTIONS ONE MUST FOLLOW WHEN APPLYING CHEMICALS TO CONTROL INSECTS AND DISEASES. THIS LIST SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) READING LABEL DIRECTIONS, (2) WEARING PROTECTIVE CLOTHING, (3) TIME OF APPLICATION, (4) PLANT AND GROWTH STAGES FOR MOST EFFECTIVE CONTROL, (5) CLEANING APPLICATORS ACCORDING TO LABEL RECOMMENDATIONS.
4. GIVE EACH STUDENT A SPECIFIC GROUP OF LANDSCAPE PLANTS AND HAVE THEM OUTLINE THE FACTORS TO CONSIDER WHEN DEVELOPING A PREVENTATIVE CONTROL PROGRAM FOR INSECTS AND DISEASES. THIS OUTLINE SHOULD INCLUDE: (1) IDENTIFYING POTENTIAL DISEASE AND INSECT PROBLEMS, (2) METHODS OF CONTROL, (3) TIME OF APPLICATION, AND (4) PLANT GROWTH STAGES MOST APPROPRIATE FOR CONTROL.

**E. INSTRUCTIONAL MATERIALS OR EQUIPMENT**

1. PLANT SPECIMENS, SLIDES, FILMSTRIPS OR PICTURES SHOWING VARIOUS INSECTS, DISEASE OR PEST DAMAGE.
2. SPRAY EQUIPMENT FOR APPLYING INSECTICIDES AND FUNGICIDES AND THE SPRAY MATERIAL NEEDED.

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. LANDSCAPE MAINTENANCE AND ESTABLISHMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: THE PENNSYLVANIA STATE UNIVERSITY, 1968, PP. 25-27.

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2. PIRONE, PASCAL P. DISEASES AND PESTS OF ORNAMENTAL PLANTS. THIRD EDITION, NEW YORK, NEW YORK: RONALD PRESS. 1960, 546 PAGES.

A COMPREHENSIVE REFERENCE FOR DETERMINING INSECT AND DISEASE DAMAGE, AS WELL AS RECOMMENDED CONTROLS. BECAUSE OF THE 1960 PUBLICATION DATE, CARE SHOULD BE TAKEN THAT THE RECOMMENDED CHEMICALS MEET CURRENT FEDERAL AND STATE REGULATIONS.

## PRUNING LANDSCAPE PLANTS AND TREES

**UNIT CONCEPT:** BECAUSE TREES AND SHRUBS AND HEDGES REQUIRE PRUNING TO REMOVE DEAD OR INJURED PARTS TO STIMULATE GROWTH AND/OR TO MAINTAIN A FORMAL SHAPE, IT IS NECESSARY THAT THE LANDSCAPE SERVICE EMPLOYEE BE ABLE TO SELECT AND REMOVE UNNECESSARY BRANCHES.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN AN INJURED TREE OR SHRUB, DEMONSTRATE THE PROCEDURE FOR REMOVING AND/OR REPAIRING THE INJURY TO THE SATISFACTION OF THE TEACHER OR INDUSTRY STANDARDS.
2. WHEN GIVEN A SHRUB IN NEED OF REJUVENATION, REMOVE THE NECESSARY WOOD TO RESTORE THE SHRUB'S YOUTHFUL APPEARANCE ACCORDING TO INDUSTRY RECOMMENDATIONS.
3. WHEN GIVEN AN ODD SHAPED SHRUB, RECOMMEND CORRECTIVE PRUNING PROCEDURES TO DEVELOP A MORE BALANCED AND COMPACT APPEARANCE TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER.
4. WHEN GIVEN A FORMAL HEDGE AND THE INTENDED CONFORMATION, SHEAR IT TO MAINTAIN A THICK AND COMPACT GROWTH WHICH WILL MATCH THE DESIRED CONFORMATION.

### B. INSTRUCTIONAL AREAS

1. REPAIRING INJURED PLANTS
  - A. UNDERSTANDING THE IMPORTANCE OF PRUNING
  - B. DETERMINING TYPE OF INJURY
  - C. SELECTING PRUNING EQUIPMENT
  - D. REMOVING BROKEN BRANCHES
  - E. REMOVING DEAD BRANCHES
  - F. REMOVING AND TREATING TORN BARK

**2. REJUVENATING OLD SHRUBS**

- A. DETERMINING AMOUNT OF PRUNING NEEDED
- B. DETERMINING TIME FOR PRUNING
- C. SELECTING EQUIPMENT TO USE
- D. PRUNING PROCEDURES AND TREATMENT

**3. DEVELOPING FORM IN SHRUBBERY**

- A. DETERMINING TYPE OF FORM DESIRED
- B. DETERMINING TYPE OF EQUIPMENT TO USE
- C. DETERMINING TIME FOR PRUNING AND TRIMMING

**4. MAINTAINING FORMAL HEDGES**

- A. DETERMINING SHAPE OF HEDGE
- B. DETERMINING TIME OF TRIMMING
- C. SELECTING EQUIPMENT TO USE

**5. PRUNING MATURE TREES**

- A. DETERMINING TIME FOR PRUNING
- B. DETERMINING LIMBS AND BRANCHES THAT NEED TO BE REMOVED
- C. SELECTING NEEDED EQUIPMENT
- D. UNDERCUTTING PROCEDURES
- E. FINAL CUTTING PROCEDURES
- F. APPLYING WOUND DRESSING TO TREE WOUNDS

**C. EXAMPLES OF STUDENT LEARNING ACTIVITIES**

- 1. STUDENTS SHOULD PRACTICE PRUNING A VARIETY OF TREES AND SHRUBS COMMONLY FOUND IN LANDSCAPED AREAS THAT HAVE INJURIES NEEDING REPAIR THROUGH PRUNING TECHNIQUES.
- 2. HAVE STUDENTS STUDY PICTURES OR ACTUAL TREES AND SHRUBS AND DETERMINE WHICH ONES NEED PRUNING FOR REJUVENATION THEN OUTLINE THE STEPS OR PROCEDURES FOR ACCOMPLISHING THIS REJUVENATION.



3. LOCATE TREES AND SHRUBS WHICH CAN BE USED TO DEVELOP PRUNING SKILLS IN REMOVING INJURED LIMBS, REPAIRING DAMAGED BARK, AND CORRECTING FOR ODD SHAPE. THEN HAVE STUDENTS CORRECT THESE DEFICIENCIES BY USING RECOMMENDED PROCEDURES.
4. HAVE STUDENTS BUILD A WOODEN FRAME TO USE AS A GUIDE FOR SHEARING A FORMAL HEDGE TO MAINTAIN A THICK AND COMPACT GROWTH.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING DRAWINGS OF TREES OR SHRUBS WITH DEAD OR BROKEN BRANCHES OR INJURED LIMBS, HAVE STUDENT DESCRIBE ORALLY OR DEMONSTRATE WHICH BRANCHES OR LIMBS SHOULD BE REMOVED AND WHERE CUTS SHOULD BE MADE WITH COMPLETE ACCURACY.
2. EACH STUDENT SHOULD DESCRIBE IN WRITING OR ORALLY THE PROCEDURE FOR REJUVENATING SHRUBS, BOTH DECIDUOUS AND EVERGREEN, AND MUST INCLUDE IN THEIR RESPONSE FOR DECIDUOUS SHRUBS: (1) CUTTING ALL WOOD TO GROUND LEVEL IN EARLY SPRING, (2) MULCHING, AND (3) TRIMMING SPROUTS IN FIRST SEASON. FOR EVERGREEN SHRUBS, THEY MUST INCLUDE: (1) REMOVING LONG BRANCHES IN APRIL, AND (2) MULCHING.
3. USING PICTURES OF SHRUBS WITH ODD SHAPES, HAVE STUDENTS DESCRIBE ORALLY OR IN WRITING THE PROCEDURE(S) WHICH NEED TO BE CARRIED OUT IN ORDER TO DEVELOP A MORE BALANCED AND COMPACT SHRUB. THIS DESCRIPTION SHOULD INCLUDE WHERE CUTS SHOULD BE MADE AND EQUIPMENT NEEDED TO ACCOMPLISH THE TASK.
4. EACH STUDENT SHOULD LIST THE "POINTS TO REMEMBER" IN TRIMMING AND MAINTAINING FORMAL HEDGES. THIS LIST SHOULD INCLUDE: (1) TIME OF YEAR FOR VARIOUS TYPES OF HEDGES, (2) BASE SHOULD BE WIDER THAN THE TOP, AND (3) AVOID DEEP CUTS INTO WOOD.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. LADDERS
2. PRUNING SHEARS
3. SHEARS OR HEDGE CLIPPERS
4. LOPPING SHEARS, HAND SAW, OR POWER SAW
5. TREE WOUND DRESSING (OR SUITABLE LEAD PAINT)

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. FIFTY LABORATORY EXERCISES FOR VOCATIONAL HORTICULTURE STUDENTS. DANVILLE, ILLINOIS: THE INTERSTATE PRINTERS AND PUBLISHERS, INC. PP. 47-52.

A PUBLICATION WHICH CONTAINS LABORATORY EXERCISES (PURPOSE, PROCEDURES, EQUIPMENT, ETC.) WHICH ASSIST IN DEVELOPING THE COMPETENCIES COVERED IN THIS UNIT.

2. LANDSCAPE MAINTANANCE AND ESTABLISHMENT. UNIVERSITY PARK, PENNSYLVANIA: PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 12-17.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THEIR RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT.

3. ORNAMENTAL HORTICULTURE SOURCE UNITS FOR VOCATIONAL TEACHERS. DANVILLE, ILLINOIS: THE INTERSTATE PRINTERS AND PUBLISHERS, INC. PP. 79-93.

A PUBLICATION DIVIDED INTO SEVEN HORTICULTURAL AREAS (TURF, PLANT PROPAGATION, GREENHOUSE MANAGEMENT, ARBORICULTURE, NURSERY MANAGEMENT, LANDSCAPING, AND FLOWERS AND FLORAL ARRANGEMENTS) WHICH CONTAIN PROBLEM AREA OUTLINES, TEACHING AIDS, LABORATORY EXERCISES AND STUDY QUESTIONS AND ANSWERS FOR EACH OF THE FIVE AREAS.

V

NURSERY PRODUCTION  
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IDENTIFICATION AND SELECTION OF NURSERY STOCK  
PLANTING MEDIA PREPARATION  
PLANTING AND TRANSPLANTING NURSERY STOCK  
SEXUAL PROPAGATION  
PROPAGATION BY CUTTINGS  
GRAFTING AND BUDDING  
FERTILIZATION OF NURSERY STOCK  
PRUNING NURSERY STOCK  
NURSERY WEED CONTROL  
NURSERY DISEASE, INSECT AND PEST CONTROL  
SAFE USE OF PEST CONTROL CHEMICALS

## IDENTIFICATION AND SELECTION OF NURSERY STOCK

**UNIT CONCEPT:** TREES AND SHRUBS USED IN NURSERY WORK HAVE A VARIETY OF CHARACTERISTICS WHICH LEND THEMSELVES TO VARYING ENVIRONMENTAL AND LANDSCAPE PLANNING CONDITIONS AND NEEDS. AN UNDERSTANDING OF THE TREE'S CHARACTERISTICS TOWARD ENVIRONMENTAL ADAPTATION AND MEETING LANDSCAPE PLANNING WILL DEFINE PLANTS WHICH WILL PROVIDE A PLEASING EFFECT OF FUNCTIONAL LANDSCAPE PURPOSE ALONG WITH APPROPRIATE ADAPTATION TO AN EXISTING ENVIRONMENT.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A GROUP OF TREES AND SHRUBS COMMON TO THE LOCAL AREA, CORRECTLY IDENTIFY EACH BY COMMON NAME OR BY SCIENTIFIC NAME WITH THE AID OF REFERENCES OR AN IDENTIFICATION KEY.
2. WHEN GIVEN SETS OF LANDSCAPING PLANS THAT CALL FOR PLANTS BY PHYSICAL SIZE AND A LIST OF AVAILABLE NURSERY STOCK, SPECIFY THOSE PLANTS THAT WILL FIT THE SPACE.
3. WHEN GIVEN A GROUP OF TREES AND SHRUBS, SELECT THOSE THAT BEST MEET THE REQUIREMENTS FOR THEIR INTENDED FUNCTION.

### B. INSTRUCTIONAL AREAS

#### 1. IDENTIFYING TREES AND SHRUBS

##### A. IDENTIFYING DECIDUOUS TREES

- (1) DETERMINING LEAF ARRANGEMENT
- (2) DETERMINING LEAF COMPOSITION
- (3) DETERMINING LEAF MARGIN CHARACTERISTICS
- (4) USING BUDS AND BUD SCARS AS INDICATORS FOR IDENTIFICATION
- (5) USING COLOR, SIZE AND SHAPE FOR IDENTIFICATION

##### B. IDENTIFYING EVERGREENS

- (1) DETERMINING NEEDLE SIZE
- (2) DETERMINING NEEDLE ARRANGEMENT

(3) USING COLOR AS AN IDENTIFICATION INDICATOR

C. IDENTIFYING BROADLEAF EVERGREENS

- (1) RECOGNIZING TWIG CHARACTERISTICS
- (2) RECOGNIZING LEAF CHARACTERISTICS

2. SELECTING ACCORDING TO TREE AND SHRUB REQUIREMENTS

- A. DETERMINING ADAPTABILITY TO ENVIRONMENTAL CONDITIONS
- B. DETERMINING HARDINESS CAPABILITIES
- C. DETERMINING NUTRITIONAL NEEDS
- D. DETERMINING DISEASE AND INSECT RESISTANCE
- E. DETERMINING MAINTENANCE REQUIREMENTS

3. SELECTING ACCORDING TO FUNCTION

- A. DETERMINING SHAPE OF TREES
- B. DETERMINING GROWTH CHARACTERISTICS
- C. DETERMINING TEXTURE OF ESTABLISHED TREES AND SHRUBS
- D. ESTIMATING COST OF DESIRABLE TREES AND SHRUBS

C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. A. HAVE STUDENTS USE PLANT AND SHRUB KEYS TO IDENTIFY VARIOUS TREES AND SHRUBS ON AND AROUND THE SCHOOL GROUNDS. OTHER KEYS CAN ALSO BE USED IF AVAILABLE.  
  
B. HAVE STUDENTS BRING IN VARIOUS TWIGS, LEAVES, ETC., TO IDENTIFY BY USING PLANT KEYS. THIS COULD ALSO SERVE AS A "CONTEST" TO FIND OUT WHICH STUDENT COULD BRING IN THE MOST SPECIMENS AND IDENTIFY THEM.
- 2. USING LANDSCAPE PLANS, HAVE STUDENTS MAKE UP A RECOMMENDED LIST OF TREES AND SHRUBS THAT WILL MEET THE NEEDS OF THESE PLANS.
- 3. TAKE A WALKING FIELD TRIP FOR THE PURPOSE OF TREE IDENTIFICATION WITHOUT THE USE OF HELP. THIS WILL SERVE AS AN ALTERNATIVE FOR CLASSROOM STUDY AS WELL AS PROVIDE AN EDUCATIONAL OBJECTIVE.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. SET UP A MATCHING EXERCISE USING PICTURES, SLIDES OR OTHER VISUAL AIDES AND HAVE STUDENTS MATCH THE "VISUALS" WITH A LIST OF TREES AND SHRUBS OF THE LOCAL AREA WITHOUT THE USE OF REFERENCES. STUDENTS SHOULD HAVE MASTERY OF IDENTIFICATION OF AT LEAST FIFTY TREES AND FIFTY SHRUBS FOR BASIC COMPETENCE WITHOUT THE USE OF AN IDENTIFICATION KEY.
2. EACH STUDENT MUST INDICATE ORALLY OR IN WRITING WHICH SHRUBS OR TREES WOULD BE MOST APPROPRIATE TO USE FOR A GIVEN LANDSCAPE PLAN WHICH CALLS FOR PLANTS BY PHYSICAL SIZE AND SHAPE. STUDENTS MUST HAVE A KNOWLEDGE OF THESE CHARACTERISTICS OF TREES AND SHRUBS IN ORDER TO CORRECTLY COMPLETE THIS EXERCISE.
3. WITH A LIST OF TREES AND SHRUBS CLASSIFIED BY SHAPE, GROWTH CHARACTERISTICS, AND TEXTURE, EACH STUDENT MUST INDICATE IN WRITING OR ORALLY THE BEST USE OF EACH (FUNCTION) WITH COMPLETE ACCURACY.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. LANDSCAPE PLANS (THESE CAN BE VERY SIMPLE OR MORE DETAILED, DEPENDING UPON SOURCE.) REFERENCES CITED GIVE SOME EXCELLENT EXAMPLES.
2. PLANT KEYS FOR COMMON TREES AND LANDSCAPE SHRUBS.
3. TWIGS, LEAVES AND PLANTS FOR IDENTIFICATION. PICTURES, DRAWINGS, SLIDES, OR OTHER SIMILAR AIDS CAN ALSO BE USED.

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. NURSERY WORKER, PART I. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 63-71.

THE FIRST OF A TWO-VOLUME SET OF REFERENCE MATERIALS FOR A NURSERY WORKER COURSE OF STUDY. PAGES CITED DEAL SPECIFICALLY WITH IDENTIFICATION AND CHARACTERISTICS OF ORNAMENTAL PLANTS (TREES AND SHRUBS).

2. SHRUBS FOR LANDSCAPING. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1972.

A PUBLICATION WHICH DEALS WITH SHRUB IDENTIFICATION AS WELL AS SOME ADDITIONAL INFORMATION ON SHRUB SELECTION AND SOIL PREPARATION AND PLANTING OF SHRUBS.

3. TREES FOR LANDSCAPING. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1972.

THIS IS AN EXCELLENT REFERENCE SOURCE FOR TREE IDENTIFICATION WHICH INCLUDES A DISCUSSION OF HOW TREES ARE NAMED, INDICATORS FOR IDENTIFYING TREES, THE USE OF A SIMPLIFIED PLANT KEY AS WELL AS SOME CONSIDERATIONS FOR TREE CULTURE.

## PLANTING MEDIA PREPARATION

**UNIT CONCEPT:** PLANTING MEDIA (SOIL MIXTURE) IS AN ESSENTIAL COMPONENT FOR SATISFACTORY GROWTH AND DEVELOPMENT OF NURSERY STOCK. IT IS ESSENTIAL THAT THE STUDENT BECOME PROFICIENT IN PROPER MEDIA PREPARATION.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A CHOICE OF MATERIALS, SELECT THOSE THAT MEET BASIC REQUIREMENTS, AND PREPARE THE FOLLOWING MEDIA ACCORDING TO INDUSTRY STANDARDS: (1) ROOTING, (2) POTTING, AND (3) FINE SEEDED.
2. WHEN GIVEN A CHEMICAL STERILANT, DEMONSTRATE THE PROCEDURE, WITH PROPER SAFETY PRECAUTIONS, IN PASTEURIZING A BENCH OF MEDIA ACCORDING TO INDUSTRY STANDARDS.
3. WHEN GIVEN AN ORGANIC MULCH MATERIAL AND ADEQUATE HAND TOOLS, APPLY A MULCH TO YOUNG NURSERY STOCK TO THE SATISFACTION OF THE INSTRUCTOR.

### B. INSTRUCTIONAL AREAS

1. DETERMINING REQUIREMENTS FOR MEDIA IN RELATION TO NURSERY STOCK (CROP) TO BE GROWN
  - A. SOIL STRUCTURE FOR AERATION
  - B. DETERMINING NUTRIENT AVAILABILITY OF SOIL
  - C. DETERMINING NEEDED PH RANGE FOR NURSERY CROPS TO BE GROWN
  - D. DETERMINING EXPENSE OF VARIOUS MEDIA COMPONENTS
2. SELECTING MATERIALS USED IN PLANTING MEDIA
  - A. IDENTIFYING TYPES AND CHARACTERISTICS OF MATERIALS USED FOR PLANTING MEDIA



B. DETERMINING TYPE OF MEDIA MATERIAL OR MIXTURES FOR PARTICULAR NURSERY CROPS

### 3. PASTEURIZING MEDIA FOR NURSERY CROPS

A. METHODS OF PASTEURIZATION

B. SELECTING CHEMICAL FUMIGANTS TO USE

C. APPLYING CHEMICAL FUMIGANTS ACCORDING TO RECOMMENDED PROCEDURES AND SAFETY PRECAUTIONS

D. PASTEURIZING MEDIA WITH STEAM

(1) DETERMINING PRESSURE OF STEAM

(2) DETERMINING AND MAINTAINING PROPER TEMPERATURE

### 4. MULCHING NURSERY PLANTS

A. PURPOSE OF MULCHING

B. IDENTIFYING TYPES AND CHARACTERISTICS OF MULCHING MATERIALS

C. PROCEDURE FOR APPLYING MULCHES

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. PROVIDE VARIOUS MATERIALS USED IN PLANTING MEDIA AND HAVE STUDENTS IDENTIFY THE MOST COMMONLY USED ONES AND GIVE CHARACTERISTICS AND MOST COMMON USE OF EACH.

B. USING VARIOUS MATERIALS, HAVE STUDENTS SELECT PROPER MATERIALS AND PREPARE PLANTING MEDIA FOR BENCHES, CONTAINERS AND SEEDINGS.

2. A. HAVE STUDENTS CHEMICALLY PASTEURIZE SOIL MIXTURES USING AT LEAST TWO DIFFERENT CHEMICALS. (IF GREENHOUSE FACILITIES ARE NOT AVAILABLE, USE SMALL WOODEN FLATS FOR ILLUSTRATIVE PURPOSES.)

B. USING LABELS FROM CHEMICAL STERILANTS, HAVE STUDENTS LIST SAFETY PRECAUTIONS TO OBSERVE DURING AND AFTER APPLICATION.

3. A. HAVE STUDENTS MAKE INDIVIDUAL OR SMALL GROUP SURVEYS TO FIND VARIOUS TYPES OF MULCHES OR GROUND COVERINGS, AND LIST WHERE IT IS USED AND THE REASON FOR USE (I.E., EROSION CONTROL, WEED CONTROL, INSULATION, ETC.).

B. HAVE STUDENTS APPLY MULCHES TO YOUNG NURSERY STOCK USING VARIOUS LOOSE MATERIALS AS WELL AS BLACK POLYETHYLENE AND THEN COMPARE.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. HAVE EACH STUDENT LIST EIGHT CHARACTERISTICS OF A DESIRABLE SOIL MIX. THIS LIST SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) UNIFORMITY, (2) DISEASE FREE, (3) LOW SOLUBLE SALTS, (4) GOOD DRAINAGE, (5) GOOD MOISTURE RETENTION, (6) NO SHRINKAGE, (7) EASE OF PREPARATION AND STORAGE AND (8) COMPLETE AVAILABILITY.
2. DEVELOP A MATCHING TEST USING VARIOUS CHEMICAL FUMIGANTS IN ONE COLUMN AND TYPES OF ORGANISMS CONTROLLED (FUNGI, BACTERIA, NEMATODES) IN ANOTHER COLUMN. EACH STUDENT SHOULD CORRECTLY MATCH 95% OF THE FUMIGANTS WITH THE RESPECTIVE ORGANISM.
3. EACH STUDENT SHOULD BE ABLE TO LIST AND EXPLAIN THE FUNCTIONS OF A MULCH FOR A CROP WITH 95% ACCURACY. THIS LIST SHOULD INCLUDE THE FOLLOWING ITEMS: (1) INSULATION, (2) CONSERVE SOIL MOISTURE, (3) PREVENT EROSION, (4) PREVENT WEED BUILD-UP, (5) IN CONTAINER STOCK, SOIL COMPACTION IS PREVENTED AND (6) SOURCE OF ORGANIC MATTER.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. VARIOUS MEDIA MATERIALS (AT LEAST 5 DIFFERENT ONES)
2. PLANTING CONTAINERS
3. CHEMICAL STERILANTS (FUMIGANTS), AT LEAST THREE
4. PLANTING BENCHES OR SIMULATIONS IF GREENHOUSE FACILITIES ARE NOT AVAILABLE
5. PLANTING TOOLS (HAND)
6. MULCHING MATERIALS

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. THE NURSERY WORKER, PART I. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 53-59.

ONE OF A TWO-VOLUME SET OF REFERENCE MATERIALS FOR A NURSERY WORKER COURSE OF STUDY. MATERIAL COVERED IN

PART I DEALS WITH INTRODUCTION TO THE NURSERY INDUSTRY, SOILS, IDENTIFICATION OF ORNAMENTAL PLANTS, PLANT GROWTH AND PLANT NUTRITION.

2. NURSERY WORKER, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, PENNSYLVANIA STATE UNIVERSITY. 1971, PP. 150-153.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE WHICH IS DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THE RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT.

3. ORNAMENTAL HORTICULTURE FOR VOCATIONAL AGRICULTURE IN ALABAMA. MONTGOMERY, ALABAMA: AGRIBUSINESS EDUCATION SERVICE, STATE DEPARTMENT OF EDUCATION. 1971, PP. 94-98.

A COMPREHENSIVE REFERENCE FOR THE STUDENT OR TEACHER IN ORNAMENTAL HORTICULTURE COVERING ALL AREAS OF THIS TAXONOMY INCLUDING NURSERY, FLORAL CROP PRODUCTION, GREENHOUSE CONSTRUCTION, LANDSCAPE DESIGN, TURF CARE AND MERCHANDISING HORTICULTURAL PLANTS AND SUPPLIES. A STUDENT STUDY GUIDE IS ALSO AVAILABLE.

## PLANTING AND TRANSPLANTING NURSERY STOCK

**UNIT CONCEPT:** PROPER PLANTING AND TRANSPLANTING OF NURSERY STOCK BY THE NURSERY WORKER HELPS PROVIDE A PRODUCT FOR THE CONSUMER THAT IS EASY TO HANDLE AND ONE THAT WILL HELP TO INSURE FUTURE GROWTH AND DEVELOPMENT.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN SAMPLES OF NURSERY SEEDLINGS, IDENTIFY THE SAMPLES THAT ARE READY FOR TRANSPLANTING.
2. WHEN GIVEN A LANDSCAPE PLAN AND VARIOUS TYPES OF TREES WHICH ARE BARERoot, BALLED AND BURLAPPED, TRANSPLANT EACH USING THE RECOMMENDED PROCEDURE AND PRACTICE.
3. WHEN GIVEN TREES NEEDING PROTECTION FROM WINTER WINDS AND TEMPERATURES, PROPERLY WRAP AND STAKE THE TREES ACCORDING TO INDUSTRY STANDARDS.
4. WHEN GIVEN NEWLY PLANTED NURSERY STOCK, DEMONSTRATE THE RECOMMENDED METHOD OF WATERING TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER.
5. WHEN GIVEN AN ORGANIC MULCH MATERIAL AND SUFFICIENT HAND TOOLS, APPLY A MULCH TO THE TREES AND SHRUBS TO CONSERVE MOISTURE, MAINTAIN AN EVEN SOIL TEMPERATURE AND ADD TO : THE BEAUTY OF THE SURROUNDINGS.

### B. INSTRUCTIONAL AREAS

1. TRANSPLANTING TREES
  - A. IDENTIFYING SEEDLINGS READY FOR TRANSPLANTING
  - B. DETERMINING TIME FOR TRANSPLANTING
  - C. PREPARING THE HOLE FOR TRANSPLANTING
    - (1) DETERMINING PROPER DEPTH
    - (2) DETERMINING PROPER WIDTH
  - D. PRUNING ROOTS OF BARERoot PLANTS

- E. REMOVING OR LOOSENING BURLAP
- F. SETTING THE TREE IN HOLE
- G. REPACKING THE SOIL
- H. FERTILIZING AND WATERING
- I. PRUNING THE NEWLY PLANTED TREE
- 2. WRAPPING AND STAKING TREES
  - A. IDENTIFY TREES REQUIRING WRAPPING
  - B. SELECTING WRAPPING MATERIAL
  - C. WRAPPING THE TREE
  - D. SELECTING THE METHOD OF SUPPORTING THE TREE
  - E. STAKING THE TREE FOR SUPPORT
- 3. TRANSPLANTING SHRUBS
  - A. CARING FOR BAREROOT, BALLED AND BURLAPPED AND CONTAINER-GROWN STOCK
  - B. DETERMINING TIME FOR TRANSPLANTING
  - C. DETERMINING PROPER SPACING
  - D. PREPARING HOLE FOR TRANSPLANTING
  - E. REPACKING SOIL AROUND SHRUB
  - F. FERTILIZING AND WATERING
  - G. PRUNING
  - H. PROTECTING SHRUBS FROM WATER LOSS
- 4. MULCHING TREES AND SHRUBS
  - A. DETERMINING PURPOSE OF MULCHING
  - B. SELECTING THE PROPER MULCH
  - C. APPLYING MULCHES
    - (1) DETERMINING TIME TO APPLY
    - (2) DETERMINING DEPTH OF MULCH NEEDED

### **C. EXAMPLES OF STUDENT LEARNING ACTIVITIES**

1. USING RECENTLY PLANTED SEEDLINGS, HAVE STUDENTS SELECT THOSE THAT ARE AT A PROPER GROWTH STAGE FOR TRANSPLANTING.
2. HAVE STUDENTS TRANSPLANT VARIOUS TYPES OF PLANTS WHICH ARE BARERoot, BALLED AND BURLAPPED, AND CONTAINER-GROWN STOCK. THIS COULD BE DONE TO BEAUTIFY THE SCHOOL GROUNDS AS A PROJECT OF THE FFA CHAPTER OR IN COOPERATION WITH OTHER SCHOOL OR COMMUNITY GROUPS.
3. A. HAVE STUDENTS MAKE CHARTS, OR TRANSPARENCIES OF THE PROPER PLANTING, STAKING AND WRAPPING OPERATIONS FOR USE IN CLASS AND FOR GIVING DEMONSTRATIONS TO OTHER CLASSES OR GROUPS.  
  
B. HAVE STUDENTS WRAP AND STAKE NEWLY PLANTED TREES AND SHRUBS.
4. HAVE STUDENTS PRACTICE PROPER PROCEDURES FOR WATERING TRANSPLANTED TREES AND SHRUBS.
5. IDENTIFY USES OF DIFFERENT TYPES OF MULCHES FOR LANDSCAPING; APPLY A NUMBER OF THE DIFFERENT MULCHES AND HAVE STUDENT CONSIDER EACH FOR DESIRABILITY, BEAUTY AND EFFECTIVENESS.

### **D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE**

1. PROVIDE STUDENTS WITH A VARIETY OF NURSERY STOCK SEEDLINGS AND HAVE THEM DISTINGUISH BETWEEN THOSE THAT ARE READY FOR TRANSPLANTING IN THE FIELD AND THOSE THAT ARE NOT. SELECTED SEEDLINGS MUST BE ABLE TO SURVIVE UNDER FIELD CONDITIONS AND CONTINUE PRODUCTIVE GROWTH.
2. HAVE EACH STUDENT LIST THE PROCEDURES TO FOLLOW FOR PROPERLY TRANSPLANTING BALLED AND BURLAPPED TREES AND SHRUBS. THE LISTING MUST INCLUDE TIME OF PLANTING, PROCEDURE FOR SETTING TREE IN PREPARED HOLE, PACKING THE SOIL, FERTILIZING AND WATERING, PRUNING, WRAPPING AND STAKING.
3. GIVE STUDENTS DRAWINGS OR PICTURES OF WRAPPED AND STAKED TREES, SOME OF WHICH ARE PROPERLY DONE AND OTHERS THAT ARE NOT, AND HAVE STUDENTS INDICATE THOSE WHICH ARE DONE SATISFACTORILY. FOR THOSE THAT ARE NOT, STUDENTS MUST DESCRIBE CORRECTIVE PROCEDURES IN ORDER FOR THEM TO MEET INDUSTRY STANDARDS.
4. USING PICTURES OF RECENTLY WATERED TREES OR SHRUBS, HAVE STUDENTS INDICATE THOSE THAT HAVE NOT RECEIVED SUFFICIENT

WATER, THOSE THAT ARE PROPERLY WATERED AND THOSE THAT ARE "OVER-WATERED" WITH COMPLETE ACCURACY.

5. THE STUDENT SHOULD LIST THE FACTORS TO CONSIDER WHEN SELECTING MATERIALS FOR MULCHING PURPOSES. THIS LIST MUST INCLUDE THE FOLLOWING: (1) AVAILABILITY, (2) COST COMPARISONS, (3) APPEARANCE, (4) DURABILITY, (5) RATE OF DECOMPOSITION, (6) POSSIBILITY OF PRODUCING WEED SEED, (7) DANGER OF INTRODUCING DISEASES, AND (8) POSSIBILITY OF FIRE.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. SEVERAL TREES AND SHRUBS READY FOR TRANSPLANTING
2. STRAW, SAWDUST, PEAT AND WOOD CHIPS TO USE AS MULCHES
3. STAKES, WRAPPING, STRING, HOSE AND WIRE FOR GUYING TREES
4. SHOVELS FOR PLANTING SPECIMENS
5. SEEDLINGS OF VARIOUS TYPES OF NURSERY STOCK

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. LANDSCAPE MAINTENANCE AND ESTABLISHMENT - A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 24, 47-56.

THIS IS ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE WHICH ARE DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THEIR RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT.

2. NURSERY PRODUCTION, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1971, PP. 109-114.

ANOTHER IN THE SERIES OF ORNAMENTAL HORTICULTURE MANUALS SIMILAR TO #1 WITH CONTENT DIRECTED MORE SPECIFICALLY TO NURSERY OCCUPATIONS. THE SECTION ON PLANTING AND TRANSPLANTING IS ESPECIALLY USEFUL FOR THIS UNIT.

3. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 207-216, 231-234.

PART II OF A TWO-VOLUME SET OF REFERENCE MATERIALS FOR A NURSERY WORKER COURSE OF STUDY. MATERIAL COVERED IN PART II DEALS WITH NURSERY PRACTICES INCLUDING METHODS OF PLANT PROPAGATION, FIELD PRACTICES, PEST CONTROL, MARKETING AND RECORD KEEPING. THE SECTION ON TRANS-PLANTING, STAKING AND PRUNING IS ESPECIALLY USEFUL FOR ACCOMPLISHING THE OBJECTIVES OF THIS UNIT.



## SEXUAL PROPAGATION

**UNIT CONCEPT:** BECAUSE MANY NURSERIES ARE CONDUCTING THEIR OWN PROPAGATION ACTIVITIES, THE NURSERY WORKER SHOULD MASTER THE SKILL OF SEXUAL PROPAGATION, OR CONTROLLED REPRODUCTION BY SEEDING, IN ORDER THAT AN ADEQUATE QUANTITY AND QUALITY OF NURSERY STOCK IS AVAILABLE FOR THE CONSUMER.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A SAMPLE OF SEED, DEMONSTRATE THE VARIOUS STEPS IN THE SEEDING OPERATION FROM SEEDBED PREPARATION TO THE MAINTENANCE OF SEEDBEDS IN SEEDROWS TO THE SATISFACTION OF THE INSTRUCTOR.
2. WHEN GIVEN VARIOUS SAMPLES OF SEEDS, DEMONSTRATE PROFICIENCY IN STRATIFICATION AND SCARIFICATION TREATMENT OF SEEDS TO IMPROVE GERMINATION ACCORDING TO RECOMMENDED INDUSTRY PROCEDURES.

### B. INSTRUCTIONAL AREAS

1. IDENTIFYING SOURCES OF SEED AND ACQUIRING SEED(S)
  - A. DETERMINING METHODS OF SEED COLLECTION
  - B. LOCATING SEED SOURCES
  - C. DETERMINING FACTORS TO CONSIDER IN SEED COLLECTION
2. TREATING SEEDS FOR INCREASED GERMINATION
  - A. IDENTIFYING METHODS OF SEED TREATMENT
  - B. DETERMINING EFFECTS OF LIGHT ON GERMINATION
  - C. PROCEDURE AND CONSIDERATIONS IN STRATIFICATION
    - (1) SELECTING SUBSTANCES USED IN STRATIFICATION (PEAT, SAND AND OTHERS)
    - (2) DETERMINING TEMPERATURE FOR STRATIFICATION

- (3) HOLDING PERIOD
- (4) PROVIDING FOR MOISTURE RETENTION

#### D. PROCEDURE AND CONSIDERATIONS IN SCARIFICATION

- (1) DETERMINING METHODS FOR SCARIFICATION
- (2) SELECTING AND OBTAINING EQUIPMENT AND MATERIALS FOR SCARIFICATION
- (3) SAFETY PRECAUTIONS WHEN USING SULPHURIC ACID FOR SCARIFICATION

### 3. SEEDING OPERATIONS

- A. DETERMINING TYPE OF SEEDING TO USE
- B. PROCEDURE FOR SEEDBED PREPARATION AND PLANTING
- C. PASTEURIZING SOIL MIXES
- D. MAINTAINING ENVIRONMENTAL CONDITIONS FOR SEEDBEDS AFTER SEEDING

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. VISIT A SEED PRODUCER IN THE AREA (IF AVAILABLE) AND OBSERVE ACTIVITIES INVOLVED IN SEED PRODUCTION AND MAKE NOTES, PICTURES, ETC., ON PROPER SEEDBED PREPARATION AND PLANTING TECHNIQUES.  
  
B. HAVE STUDENTS PLANT VARIOUS SEEDS AND DETERMINE AMOUNT OF TIME FOR GERMINATION.
2. A. HAVE STUDENTS SCARIFY VARIOUS SAMPLES OF SEEDS BY ALL THREE COMMON METHODS (MECHANICAL, WATER-SOAKING AND ACID) IF FACILITIES ARE AVAILABLE AND COMPARE TIME OF GERMINATION, COST, ADVANTAGES AND DISADVANTAGES OF EACH METHOD.  
  
B. HAVE STUDENTS DEMONSTRATE PROPER TECHNIQUES OF STRATIFICATION WITH VARIOUS TYPES OF SEEDS.

## D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. EACH STUDENT SHOULD DEMONSTRATE OR LIST THE STEPS IN THE SEEDING OPERATION WITH COMPLETE ACCURACY. THIS LIST SHOULD INCLUDE: (1) LOCATING SEED SOURCES, (2) ACQUIRING SEED, (3) TREATING SEED BY STRATIFICATION OR SCARIFICATION, (4) SEEDBED PREPARATION, (5) SEEDING, AND (6) MAINTAINING ENVIRONMENTAL CONDITIONS.

2. USING VARIOUS SEED SAMPLES, HAVE STUDENTS DETERMINE WHAT TYPE OF SEED TREATMENT, IF ANY, IS NEEDED AND THEN DEMONSTRATE OR EXPLAIN THE PROCEDURE FOR TREATING SEEDS WITH COMPLETE ACCURACY. THE EXPLANATION MUST INCLUDE SAFETY PRECAUTIONS NECESSARY.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. PACKETS OF A VARIETY OF SEEDS
2. SCARIFICATION DRUM
3. SULPHURIC ACID FOR SCARIFICATION
4. BENCHES FOR PLANTING
5. HAND PLANTING TOOLS

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. THE GREENHOUSE WORKER. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1974, PP. 79-94.

A STUDENT REFERENCE MANUAL PREPARED FOR STUDENTS WORKING IN GREENHOUSES WHICH CONTAINS TECHNICAL INFORMATION, INSTRUCTIONS FOR MANIPULATIVE OPERATIONS AND STUDENT EXERCISES. MATERIAL COVERED INCLUDES GREENHOUSE CONSTRUCTION, GREENHOUSE PLANTS, GREENHOUSE OPERATIONS AND PLANTING.

2. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 149-177.

PART II OF A TWO-VOLUME SET OF REFERENCE MATERIALS FOR A NURSERY WORKER COURSE OF STUDY. MATERIAL COVERED IN PART II DEALS WITH NURSERY PRACTICES INCLUDING METHODS OF PLANT PROPAGATION, FIELD PRACTICES, PEST CONTROL, MARKETING AND RECORD KEEPING.

3. ORNAMENTAL HORTICULTURE FOR VOCATIONAL AGRICULTURE IN ALABAMA. MONTGOMERY, ALABAMA: AGRIBUSINESS EDUCATION SERVICE, STATE DEPARTMENT OF EDUCATION. 1971, PP. 53-73.

A COMPREHENSIVE REFERENCE FOR THE STUDENT OR TEACHER IN ORNAMENTAL HORTICULTURE COVERING ALL AREAS OF THE TAXONOMY INCLUDING NURSERY, FLORAL CROP PRODUCTION, GREENHOUSE CONSTRUCTION, LANDSCAPE DESIGN, TURF CARE, AND MERCHANDISING HORTICULTURAL PLANTS AND SUPPLIES. A STUDY GUIDE IS ALSO AVAILABLE.

## PROPAGATION BY CUTTINGS

**UNIT CONCEPT:** PROPAGATION BY CUTTINGS, OR CAUSING ANY PORTION OF A PLANT, ROOT, STEM, LEAF OR BUD TO FORM ROOTS OF ITS OWN, IS ONE OF THE QUICKEST METHODS OF PROPAGATING NURSERY STOCK AND IT IS NECESSARY FOR THE NURSERY WORKER TO BE PROFICIENT IN THIS TECHNIQUE TO INSURE GENETIC PURITY.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN HARDWOOD AND SOFTWOOD STEM PARTS AND A KNIFE, PREPARE SPECIMENS FOR MIST BED PROPAGATION, ACCORDING TO RECOGNIZED CRITERIA.
2. WHEN GIVEN VARIOUS NURSERY PLANTS, DEMONSTRATE PROFICIENCY IN LEAF-BUD, LEAF, TERMINAL BUD AND ROOT CUTTINGS AS METHODS OF PROPAGATION AND PREPARE THE CUTTINGS FOR ROOTING.

### B. INSTRUCTIONAL AREAS

#### 1. PROPAGATING STEM CUTTINGS

##### A. IDENTIFYING TYPES OF STEM CUTTINGS

###### (1) HARDWOOD

###### (A) DECIDUOUS

###### (B) NARROW-LEAVED EVERGREENS

###### (2) SEMI-HARDWOOD (BROAD-LEAVED EVERGREENS)

###### (3) SOFTWOOD

###### (4) HERBACEOUS

##### B. PROCEDURES FOR PROPAGATING HARDWOOD-DECIDUOUS CUTTINGS

###### (1) DETERMINING TIME OF YEAR TO TAKE CUTTINGS

###### (2) CUTTING STEMS TO PROPER LENGTH AND WITH APPROPRIATE NUMBER OF NODES

###### (3) WRAPPING CUTTINGS IN BUNDLES

###### (4) DETERMINING METHOD OF PLANTING CUTTINGS FOR ROOTING

C. PROPAGATING HARDWOOD NARROW-LEAVED EVERGREEN CUTTINGS

- (1) IDENTIFYING SPECIES OF NURSERY STOCK TO BE PROPAGATED BY THIS METHOD
- (2) TAKING CUTTINGS DURING LATE FALL OR WINTER AFTER FROST
- (3) REMOVING LEAVES AT BASE OF CUTTINGS
- (4) TREATING CUTTINGS WITH HORMONES TO PROMOTE ROOT GROWTH

D. PROPAGATING SEMI-HARDWOOD AND SOFTWOOD CUTTINGS

- (1) DETERMINING LENGTH OF CUTTINGS
- (2) TRIMMING LEAVES OR USING ANTI-DESSICANTS TO PREVENT MOISTURE LOSS
- (3) PREPARING CUTTINGS FOR MISTING

E. PLANTING STEM CUTTINGS

- (1) PREPARING THE HOLE FOR FIELD PLANTING
- (2) PLACING CUTTING IN HOLE WITH BASAL SIDE DOWN
- (3) TAMPING SOIL AROUND CUTTINGS
- (4) PROCEDURES FOR GREENHOUSE BENCH PLANTING OF CUTTINGS

2. PROPAGATING BY LEAF CUTTINGS

- A. DETERMINING VARIETIES OR SPECIES TO BE PROPAGATED BY THIS METHOD
- B. PROCEDURE FOR MAKING CUTTINGS
- C. PLACING NEW CUTTINGS NEAR OR IN MOIST SOIL FOR GROWTH
- D. MAINTAINING ENVIRONMENTAL CONDITIONS NECESSARY FOR ROOTING

3. PROPAGATING BY LEAF-BUD CUTTINGS

- A. DETERMINING PLANT PORTION TO BE CUT, I.E., LEAF BLADE, PETIOLE AND PIECE OF STEM
- B. PROCEDURE FOR BURYING CUTTING IN SOIL
- C. MAINTAINING LEAF-BUD CUTTINGS

C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. A. HAVE STUDENT PRACTICE TAKING VARIOUS STEM CUTTINGS AND PREPARING THEM FOR ROOTING, BOTH UNDER FIELD CONDITIONS AS WELL AS MISTING IN A GREENHOUSE.

B. SET UP AN EXPERIMENT WITH THE CLASS AND HAVE THEM OBTAIN 10-20 SOFTWOOD CUTTINGS OF VARIOUS SPECIES, THEN TREAT HALF OF THE CUTTINGS OF EACH SPECIES WITH HORMONE ROOTING POWDER AND THEN PLANT HALF OF THEM IN GREENHOUSE BENCHES AND THE OTHER HALF IN PEAT POTS. THEN HAVE THEM RECORD THE ROOTING PROGRESS OF EACH GROUP AT TWO-, THREE- AND FOUR-WEEK INTERVALS.

2. A. STUDENTS SHOULD PRACTICE PROPAGATION OF NURSERY STOCK BY LEAF-BUD, LEAF, TERMINAL BUD AND ROOT CUTTINGS.

B. TOUR AN ESTABLISHED COMMERCIAL GREENHOUSE AND HAVE STUDENTS OBSERVE THE PROPAGATION ACTIVITIES BEING CARRIED OUT AND COMPARE VARIOUS TECHNIQUES OBSERVED IN REFERENCE TO TYPE OF PLANT PROPAGATED AND METHODS USED.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING PICTURES OR ACTUAL PROPAGATED HARDWOOD AND SOFTWOOD CUTTINGS, HAVE STUDENTS IDENTIFY OR DETERMINE THE SPECIMENS THAT HAVE BEEN CUT, ACCORDING TO RECOMMENDATIONS AND THOSE THAT ARE NOT AND THEN EXPLAIN THE PROBABLE REASON THEY WERE NOT CUT OR PREPARED PROPERLY.

2. EACH STUDENT SHOULD CORRECTLY DEMONSTRATE OR DESCRIBE THE PROCEDURE FOR PROPAGATING NURSERY PLANTS FOR EACH OF THE FOLLOWING METHODS:

A. LEAF BUD

B. LEAF

C. TERMINAL

D. ROOT

PERFORMANCE MUST BE EVALUATED AS TO ADHERANCE TO INDUSTRY STANDARDS.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. KNIVES FOR CUTTINGS --- ONE FOR EACH PAIR OF STUDENTS

2. ROOTING MEDIA

3. BENCHES FOR PLANTING

4. LABELS FOR CUTTINGS

5. VARIETY OF NURSERY STOCK SPECIES FOR MAKING CUTTINGS

6. HORMONES FOR STIMULATING ROOTING

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. NURSERY PRODUCTION. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1971, PP. 77-92.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS IN ORNAMENTAL HORTICULTURE WHICH ARE DESIGNED AS RESOURCE OR REFERENCE MATERIALS FOR THEIR RESPECTIVE HORTICULTURAL AREA. MATERIAL COVERED IS OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT.

2. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 149-180.

PART TWO OF A TWO-VOLUME SET OF REFERENCE MATERIALS FOR A NURSERY WORKER COURSE OF STUDY. MATERIAL COVERED IN PART II DEALS EXTENSIVELY WITH VARIOUS TECHNIQUES OF PROPAGATION COVERED IN THIS UNIT.

## GRAFTING AND BUDDING

**UNIT CONCEPT:** GRAFTING AND BUDDING ARE SIMILAR METHODS OF PROPAGATION WHICH PLACE A PART OF ONE PLANT ONTO ANOTHER PLANT IN SUCH A WAY THAT THE TWO PARTS UNITE AND CONTINUE TO GROW. THE NURSERY WORKER MUST DEVELOP THIS COMPETENCY IN ORDER TO PERPETUATE CERTAIN VARIETIES, UTILIZE BENEFITS FROM CERTAIN ROOTSTOCKS, CHANGE VARIETIES, REDUCE GROWING TIME, AND TO REPAIR CERTAIN TYPES OF DAMAGE.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN NURSERY STOCK TO BE PROPAGATED BY GRAFTING AND THE NECESSARY TOOLS AND MATERIALS, DEMONSTRATE THE ABILITY TO PROPAGATE PLANTS FROM GRAFTING, USING ONE OR MORE METHODS INCLUDING CLEFT GRAFTING, BENCH GRAFTING, SIDE GRAFTING, AND BARK GRAFTING ACCORDING TO RECOMMENDED PROCEDURES.
2. WHEN GIVEN PLANTS TO BE PROPAGATED BY BUDDING, DEMONSTRATE THE ABILITY TO PROPAGATE PLANTS FROM BUDDING USING THE T-BUD OR SHIELD TECHNIQUE, AS WELL AS DEMONSTRATE THE PROCESS FOR CARING FOR PLANTS AFTER THE BUDDING PROCEDURE.

### B. INSTRUCTIONAL AREAS

#### 1. PROPAGATING NURSERY STOCK BY GRAFTING

##### A. COLLECTING SCIONS

- (1) DETERMINING TYPE OF GRAFTING TECHNIQUE TO BE USED
- (2) IDENTIFYING TIME OF YEAR TO COLLECT SCIONS
- (3) TECHNIQUES OF CUTTING SCIONS

##### B. PROPAGATING BY CLEFT GRAFTING

- (1) DETERMINING PURPOSE OF CLEFT GRAFTING
- (2) SPLITTING THE ROOTSTOCK FOR GRAFTING
- (3) PREPARING THE SCION FOR INSERTING INTO ROOTSTOCK



- (4) INSERTING SCIONS SO THAT CAMBIUM LAYERS MATCH
- (5) COATING GRAFTED AREA WITH GRAFTING WAX OR OTHER PROTECTIVE MATERIALS

C. PROPAGATING BY BENCH (WHIP) GRAFTING

- (1) IDENTIFYING DIFFERENCES IN BENCH AND CLEFT GRAFTING
- (2) PREPARING THE SCION AND STOCK TO BE GRAFTED
- (3) FITTING THE SCION AND STOCK TOGETHER
- (4) WRAPPING THE GRAFT WITH SUITABLE MATERIAL FOR PROTECTION
- (5) WAXING THE GRAFTS
- (6) PROVIDING CONDITIONS FOR CALLUS FORMATION

D. PERFORMING SIDE GRAFTS WITH EVERGREENS

- (1) SELECTING SCION(S) OF APPROXIMATELY SAME SIZE AS STOCK
- (2) PREPARING THE SCION AND STOCK FOR GRAFTING
- (3) PLACING SCION AGAINST CUT SIDE OF UNDERSTOCK
- (4) PROVIDING CONDITIONS OF HIGH HUMIDITY FOR CALLUS FORMATION

E. USING BARK GRAFTING FOR PROPAGATION

- (1) PREPARING THE SCION
- (2) SPLITTING THE BARK ON THE STOCK FOR INSERTING THE SCION
- (3) PLACING SCION INTO BARK
- (4) WRAPPING OR TACKING SCION TO HOLD IT IN PLACE

2. PROPAGATION BY BUDDING

A. COLLECTING BUDS FOR PROPAGATION

- (1) DETERMINING TIME FOR COLLECTION
- (2) CUTTING BUDS FROM GROWING STOCK

B. USING THE SHIELD OR T-BUD PROCEDURE FOR BUDDING

- (1) REMOVING BUDS FROM BUDSTICK
- (2) PREPARING THE STOCK TO BE BUDDED
- (3) INSERTING THE BUD INTO THE T-CUT OF THE STOCK
- (4) WRAPPING THE BUD TO HOLD IT IN PLACE

C. CARING FOR STOCK PROPAGATED BY BUDDING

- (1) PRUNING STOCK AFTER DORMANCY PERIOD
- (2) REMOVING GROWTH ON ROOTSTOCK BELOW THE BUD
- (3) PROVIDING PROPER CULTIVATION AND WEED CONTROL

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. HAVE STUDENTS GRAFT TWO DIFFERENT VARIETIES OF PLANTS ONTO ONE PARENT ROOTSTOCK. THIS CAN BE DONE EASILY BY USING APPLE VARIETIES. THE STUDENT SHOULD ATTEMPT GRAFTING BY THE TWO MOST USED METHODS SUCH AS BENCH (WHIP) AND CLEFT.  
  
B. IF FACILITIES AND MATERIALS PERMIT, HAVE STUDENTS GRAFT VARIOUS VARIETIES ONTO A PARENT ROOTSTOCK, AND AFTER THE NEWLY GRAFTED PLANTS HAVE STARTED ACTIVE GROWTH, SELL TO PEOPLE IN THE COMMUNITY. THIS ACTIVITY COULD BE USED AS A FUND RAISING AS WELL AS A LEARNING ACTIVITY.
2. USING ACTIVELY GROWING PLANT PARTS, EACH STUDENT MAY GRAFT THESE PARTS BY T-BUDDING.

### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING ACTUAL SPECIMENS OF SCIONS PREPARED FOR CLEFT, BENCH, SIDE, AND BARK GRAFTING IN WHICH SOME ARE PREPARED PROPERLY AND OTHERS IMPROPERLY, HAVE STUDENTS IDENTIFY THE SCIONS THAT ARE PREPARED ACCORDING TO RECOMMENDED PROCEDURES. THE STUDENTS SHOULD ALSO DESCRIBE AND EXPLAIN THE REASONS THAT SCIONS WERE PREPARED IMPROPERLY. THIS ACTIVITY SHOULD BE DONE WITH COMPLETE ACCURACY.
2. HAVE STUDENTS LIST THE STEPS OR PROCEDURES IN PROPAGATING NURSERY STOCK BY THE SHIELD OR T-BUD TECHNIQUE. THIS LIST SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) REMOVING BUDS FROM THE BUDSTICK, (2) MAKING THE CUT ON THE STOCK, (3) INSERTING THE BUD BENEATH THE BARK OF THE STOCK, AND (4) WRAPPING THE BUD FIRMLY.

### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. GRAFTING TOOLS, KNIVES
2. RUBBER BANDS OR WHITE SHEETING
3. GRAFTING WAX .
4. BUD STICKS
5. PIECES OF ROOTSTOCK
6. WEDGE SHAPED SCIONS

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. FIFTY LABORATORY EXERCISES FOR VOCATIONAL ORNAMENTAL HORTICULTURE STUDENTS. DANVILLE, ILLINOIS: THE INTERSTATE PRINTERS AND PUBLISHERS, INC. PP. 71-79.

A GOOD PUBLICATION WHICH CONTAINS EXERCISES ON GRAFTING AND OTHER PROPAGATION ACTIVITIES. EXERCISES INCLUDE PURPOSE, PROCEDURES, EQUIPMENT NEEDED WHICH ASSIST IN DEVELOPING THE COMPETENCIES COVERED IN THIS UNIT.

2. NURSERY PRODUCTION. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1971, PP. 85-90.

THIS RESOURCE MANUAL GIVES A GENERAL OVERVIEW OF THE GRAFTING PROCEDURES USED IN NURSERY PRODUCTION.

3. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 180-199.

THIS REFERENCE CONTAINS STEP-BY-STEP PROCEDURES FOR EACH GRAFTING AND BUDDING TECHNIQUE COVERED WITHIN THIS UNIT AND ALSO INCLUDES ILLUSTRATIONS AND PHOTOGRAPHS OF EACH PROCEDURE.

## FERTILIZATION OF NURSERY STOCK

**UNIT CONCEPT:** BECAUSE MOST SOILS AND PLANTING MEDIA MATERIALS DO NOT CONTAIN ADEQUATE NUTRIENTS FOR OPTIMUM PLANT GROWTH, IT IS NECESSARY THAT THE NURSERY WORKER BE ABLE TO CONDITION THE PLANTING MEDIA, GENERALLY BY FERTILIZATION, IN ORDER FOR NURSERY STOCK TO ACHIEVE THE BEST GROWTH.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A MEDIA SAMPLE, DETERMINE IF A SOIL CONDITIONER IS NEEDED AND, IF SO, BLEND A SUITABLE CONDITIONER INTO A BENCH OF MEDIA ACCORDING TO INDUSTRY STANDARDS.
2. WHEN GIVEN SEVERAL FIXED ANALYSIS FERTILIZERS, DETERMINE THE POUNDS OF ACTUAL PLANT FOOD IN EACH WITHIN  $\pm$  ONE POUND.
3. WHEN GIVEN CORRECTLY CALIBRATED LIQUID AND GRANULAR FERTILIZER APPLICATORS, APPLY A PRESCRIBED AMOUNT OF MATERIALS TO A GIVEN PLOT AND PREPARE THE EQUIPMENT FOR STORAGE FOLLOWING USE TO THE SATISFACTION OF THE INSTRUCTOR.
4. WHEN USING A CONCRETE MIXER, THE STUDENT WILL ADD MICRONUTRIENTS TO PLANT MEDIA FOR A GIVEN NURSERY CROP TO THE SATISFACTION OF THE INSTRUCTOR.

### B. INSTRUCTIONAL AREAS

1. SELECTING FERTILIZERS FOR NURSERY CROPS
  - A. DETERMINING FERTILIZER COMPONENTS
  - B. DETERMINING ANALYSIS AND AMOUNT OF FERTILIZER NEEDED FOR A GIVEN CROP
    - (1) INTERPRETING SOIL TEST RESULTS
    - (2) DETERMINING COST PER POUND OF NUTRIENTS

2. APPLYING FERTILIZERS TO PLANTING MEDIA FOR A GIVEN NURSERY CROP
    - A. SELECTING MOST APPROPRIATE METHOD OF APPLYING LIQUID FERTILIZER
    - B. SELECTING MOST APPROPRIATE METHOD OF APPLYING DRY FERTILIZER
    - C. DETERMINING TIME OF APPLICATION
    - D. PROCEDURE FOR PREPARING AND APPLYING LIQUID FERTILIZERS TO NURSERY CROP AREAS
    - E. PROCEDURE FOR APPLYING GRANULAR (DRY) FERTILIZER(S) TO NURSERY CROP AREAS
    - F. SAFETY PRECAUTIONS TO CONSIDER IN APPLYING FERTILIZER
    - G. CLEANING FERTILIZER APPLICATORS AFTER USE
    - H. PROCEDURES FOR SAFE STORAGE OF FERTILIZER MATERIALS
  3. ADDING MICRONUTRIENTS TO NURSERY BENCH PLANTING MIXTURES FOR GIVEN CROPS
    - A. DETERMINING CROP NEEDS FOR MICRONUTRIENTS
    - B. SELECTING MICRONUTRIENTS FOR APPLICATION
    - C. PROCEDURE FOR MIXING MICRONUTRIENTS
- C. EXAMPLES OF STUDENT LEARNING ACTIVITIES
1. HAVE STUDENTS SAMPLE SOIL MEDIA AND SEND SAMPLES FOR TESTING TO AN ESTABLISHED LABORATORY AND REVIEW AND INTERPRET RECOMMENDATIONS WHEN THEY RETURN.
  2. WITH SEVERAL VARIOUS FERTILIZER BAGS, HAVE STUDENTS STUDY INFORMATION ON THE BAG. LOOK FOR SUCH THINGS AS ANALYSIS, POUNDS OF NUTRIENTS, CONTENTS AND INFORMATION ON PROPER APPLICATION.
  3. HAVE STUDENTS BLEND SOIL CONDITIONERS AND/OR MICRONUTRIENTS IN MEDIA WITH A CONCRETE MIXER OR OTHER SIMILAR MECHANICAL METHOD.
  4.
    - A. HAVE STUDENTS APPLY FERTILIZER IN GRANULAR AND LIQUID FORM TO A FIELD PLOT OR BENCH OF SOIL MEDIA.
    - B. USING VARIOUS FERTILIZER APPLICATORS, HAVE STUDENTS CLEAN THEM ADEQUATELY FOR STORAGE.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. EACH STUDENT SHOULD BE ABLE TO LIST THE STEPS NECESSARY TO DETERMINE IF FERTILIZATION IS NEEDED, AND IF SO, WHAT AMOUNTS, FOR A GIVEN NURSERY CROP. THIS LIST OF STEPS SHOULD INCLUDE: (1) TAKING A REPRESENTATIVE SOIL SAMPLE (PROCEDURE), (2) PREPARING SAMPLES FOR ANALYSIS, (3) INTERPRETING ANALYSIS INFORMATION, AND (4) SELECTING FERTILIZER(S) NEEDED.
2. USING FERTILIZER LABEL INFORMATION ABOUT ANALYSIS, HAVE EACH STUDENT FIGURE THE POUNDS OF ACTUAL PLANT FOOD FOR GIVEN AMOUNTS OF FERTILIZER. THIS DETERMINATION MUST BE WITHIN  $\pm$  ONE POUND FOR COMPLETE ACCURACY. THE STUDENT SHOULD ALSO DETERMINE THE COST PER POUND OF VARIOUS ANALYSES.
3. ASSIGN EACH STUDENT A PRESCRIBED AMOUNT OF FERTILIZER AND HAVE THEM CALIBRATE A LIQUID OR DRY APPLICATOR SUCH THAT THE FERTILIZER GIVES ADEQUATE COVERAGE. THIS IS AN EVALUATION PROCESS THAT SHOULD BE EVALUATED ACCORDING TO HOW WELL THE STUDENT CALIBRATES THE APPLICATOR ACCORDING TO MANUFACTURERS RECOMMENDATION.
4. ASSIGN A BENCH OR FIELD PLOT OF NURSERY CROPS SHOWING NUTRIENT DEFICIENCIES TO EACH STUDENT AND GIVE THEM RESPONSIBILITY FOR TESTING THE SOIL, INTERPRETING THE TEST RESULTS AND CARRYING OUT THE RECOMMENDATIONS. THE EVALUATION OF THIS EXERCISE IS BASED UPON THE EFFECTIVENESS OF HIS PERFORMANCE, I.E. DID THE ASSIGNED NURSERY CROP RESPOND AS EXPECTED TO THE FERTILIZER TREATMENT(S).

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. FERTILIZER OF VARYING ANALYSES INCLUDING MICRONUTRIENTS
2. SPRAYERS (LIQUID AND TANK)
3. FERTILIZER INJECTORS IS AVAILABLE (HOZON)
4. FERTILIZER BAGS FOR STUDYING INFORMATION
5. SOIL TESTING MAILING KITS (THESE CAN GENERALLY BE ACQUIRED IN COUNTY EXTENSION OFFICES)

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. THE GREENHOUSE WORKER. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1974, PP. 56-74.

A STUDENT REFERENCE MANUAL PREPARED FOR STUDENTS WORKING IN GREENHOUSES WHICH CONTAINS TECHNICAL INFORMATION, INSTRUCTIONS FOR MANIPULATIVE OPERATIONS, AND STUDENT EXERCISES. MATERIAL COVERED INCLUDED GREENHOUSE CONSTRUCTION, GREENHOUSE PLANTS, GREENHOUSE OPERATIONS, AND PLANTING.

2. ORNAMENTAL HORTICULTURE FOR VOCATIONAL AGRICULTURE IN ALABAMA. MONTGOMERY, ALABAMA: AGRIBUSINESS EDUCATION SERVICE, STATE DEPARTMENT OF EDUCATION, 1971, 349 PAGES.

A COMPREHENSIVE REFERENCE FOR THE STUDENT OR TEACHER IN ORNAMENTAL HORTICULTURE COVERING ALL AREAS OF THE TAXONOMY INCLUDING NURSERY, FLORAL CROP PRODUCTION, GREENHOUSE CONSTRUCTION, LANDSCAPE DESIGN, TURF CARE, AND MERCHANDISING HORTICULTURAL PLANTS AND SUPPLIES. A STUDY GUIDE IS ALSO AVAILABLE.

## PRUNING NURSERY STOCK

**UNIT CONCEPT:** THE NURSERY WORKER NEEDS TO DEVELOP COMPETENCIES IN PRUNING TREES AND SHRUBS IN ORDER TO ALTER THE SHAPE, SIZE AND DIRECTION OF PLANT GROWTH, WHICH IS ESSENTIAL TO ATTAIN A LEVEL OF SATISFACTION FOR THE CONSUMER.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN AN INJURED TREE OR SHRUB, DEMONSTRATE THE PROCEDURE FOR REMOVING AND/OR REPAIRING THE INJURY TO THE SATISFACTION OF THE TEACHER OR INDUSTRY STANDARDS.
2. WHEN GIVEN A SHRUB IN NEED OF REJUVENATION, REMOVE THE NECESSARY WOOD TO RESTORE THE SHRUB'S YOUTHFUL APPEARANCE ACCORDING TO INDUSTRY RECOMMENDATIONS.
3. WHEN GIVEN AN ODD SHAPED SHRUB, RECOMMEND CORRECTIVE PRUNING PROCEDURES TO DEVELOP A MORE BALANCED AND COMPACT APPEARANCE TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER.

### B. INSTRUCTIONAL AREAS

1. REPAIRING INJURED PLANTS
  - A. UNDERSTANDING THE IMPORTANCE OF PRUNING
  - B. DETERMINING TYPE OF INJURY
  - C. SELECTING PRUNING EQUIPMENT
  - D. REMOVING BROKEN BRANCHES
  - E. REMOVING DEAD BRANCHES
  - F. REMOVING AND TREATING TORN BARK
2. REJUVENATING OLD SHRUBS
  - A. DETERMINING AMOUNT OF PRUNING NEEDED
  - B. DETERMINING TIME FOR PRUNING



C. SELECTING EQUIPMENT TO USE

D. PRUNING PROCEDURES AND TREATMENT

### 3. DEVELOPING FORM IN SHRUBBERY

A. DETERMINING TYPE OF FORM DESIRED

B. DETERMINING TYPE OF EQUIPMENT OR USE

C. DETERMINING TIME FOR PRUNING AND TRIMMING

### 4. PRUNING MATURE TREES

A. DETERMINING TIME FOR PRUNING

B. DETERMINING LIMBS AND BRANCHES THAT NEED TO BE REMOVED

C. SELECTING NEEDED EQUIPMENT

D. UNDERCUTTING PROCEDURES

E. FINAL CUTTING PROCEDURES

F. APPLYING WOUND DRESSING TO TREE WOUNDS

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. FOR A VARIETY OF SHRUBS AND TREES, HAVE STUDENTS DETERMINE THE PROCEDURE THEY SHOULD USE TO PRUNE INJURED BRANCHES, LIMBS, ETC. AND THE WOUND DRESSINGS THEY SHOULD USE.
2. HAVE STUDENTS STUDY PICTURES OR ACTUAL TREES AND SHRUBS AND DETERMINE WHICH ONES NEED PRUNING FOR REJUVENATION, THEN OUTLINE THE STEPS OR PROCEDURES FOR ACCOMPLISHING THIS REJUVENATION.
3. LOCATE TREES AND SHRUBS WHICH CAN BE USED TO DEVELOP PRUNING SKILLS IN REMOVING INJURED LIMBS, REPAIRING DAMAGED BARK, AND CORRECTING FOR ODD SHAPE. THEN HAVE STUDENTS CORRECT THESE DEFICIENCIES BY USING RECOMMENDED PROCEDURES.

## D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING DRAWINGS OF TREES OR SHRUBS WITH DEAD OR BROKEN BRANCHES OR INJURED LIMBS, HAVE STUDENT DESCRIBE ORALLY OR DEMONSTRATE WHICH BRANCHES OR LIMBS SHOULD BE REMOVED AND WHERE CUTS SHOULD BE MADE WITH COMPLETE ACCURACY.

2. EACH STUDENT SHOULD DESCRIBE IN WRITING OR ORALLY THE PROCEDURE FOR REJUVENATING SHRUBS, BOTH DECIDUOUS AND EVERGREEN, AND MUST INCLUDE IN THEIR RESPONSE FOR DECIDUOUS SHRUBS: (1) CUTTING ALL WOOD TO GROUND LEVEL IN EARLY SPRING, (2) MULCHING, AND (3) TRIMMING SPROUTS IN FIRST SEASON. FOR EVERGREEN SHRUBS, THEY MUST INCLUDE: (1) REMOVING LONG BRANCHES IN APRIL, AND (2) MULCHING.
3. USING PICTURES OF SHRUBS WITH ODD SHAPES, HAVE STUDENTS DESCRIBE ORALLY OR IN WRITING THE PROCEDURE(S) WHICH NEED TO BE CARRIED OUT IN ORDER TO DEVELOP A MORE BALANCED AND COMPACT SHRUB. THIS DESCRIPTION SHOULD INCLUDE WHERE CUTS SHOULD BE MADE AND EQUIPMENT NEEDED TO ACCOMPLISH THE TASK.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. LADDERS
2. PRUNING SHEARS
3. SHEARS OR HEDGE CLIPPERS
4. LOPPING SHEARS, HAND SAW, OR POWER SAW
5. TREE WOUND DRESSING (OR SUITABLE LEAD PAINT)

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. FIFTY LABORATORY EXERCISES FOR VOCATIONAL HORTICULTURE STUDENTS. DANVILLE, ILLINOIS: THE INTERSTATE PRINTERS AND PUBLISHERS, INC. PP. 47-52.

A PUBLICATION WHICH CONTAINS LABORATORY EXERCISES (PURPOSE, PROCEDURES, EQUIPMENT, ETC.) WHICH ASSIST IN DEVELOPING THE COMPETENCIES COVERED IN THIS UNIT.

2. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 216-226.

MATERIAL COVERED ON PRUNING IS QUITE COMPREHENSIVE AND OF SUFFICIENT BREADTH TO COVER THE OBJECTIVES OF THIS UNIT ON PRUNING. CONTENT IS EASILY UNDERSTOOD BY STUDENTS.

3. ORNAMENTAL HORTICULTURE SOURCE UNITS FOR VOCATIONAL TEACHERS. DANVILLE, ILLINOIS: THE INTERSTATE PRINTERS AND PUBLISHERS, INC. PP. 79-93.

A PUBLICATION DIVIDED INTO SEVEN HORTICULTURAL AREAS (TURF, PLANT PROPAGATION, GREENHOUSE MANAGEMENT, ARBORICULTURE, NURSERY MANAGEMENT, LANDSCAPING, AND FLOWERS AND FLORAL ARRANGEMENTS) WHICH CONTAIN PROBLEM AREA OUTLINES, TEACHING AIDS, LABORATORY EXERCISES AND STUDY QUESTIONS AND ANSWERS FOR EACH OF THE FIVE AREAS.

## NURSERY WEED CONTROL

**UNIT CONCEPT:** WEEDS ARE MISPLACED PLANTS THAT ACT TO USE UP LIGHT, MOISTURE AND NUTRIENTS NEEDED BY NURSERY STOCK AND IT IS NECESSARY THAT THE NURSERY WORKER BE PROFICIENT IN IDENTIFYING AND EFFECTIVELY CONTROLLING THESE UNWANTED PLANTS IN ORDER TO ALLOW FOR MORE PRODUCTIVE GROWTH OF NURSERY STOCK.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A SITUATION OF VARIOUS WEEDS GROWING IN ORNAMENTAL PLANTS, IDENTIFY THE WEED, SELECT AND CONDUCT APPROPRIATE PROCEDURES AND PROCESSES NECESSARY FOR CONTROLLING THE WEEDS.
2. WHEN GIVEN A SITUATION OF VARIOUS WEEDS GROWING IN A GROUP OF CONTAINER PLANTS, IDENTIFY THE WEEDS, SELECT AND CONDUCT APPROPRIATE PROCEDURES AND PROCESSES NECESSARY FOR CONTROLLING THE WEEDS, ACCORDING TO LABEL DIRECTIONS AND TO THE SATISFACTION OF THE INSTRUCTOR.
3. WHEN GIVEN CHEMICAL WEED CONTROL SPRAYERS, DEMONSTRATE THE ABILITY TO PROPERLY CALIBRATE THE SPRAYER AND, FOLLOWING USE, CLEAN THE EQUIPMENT FOR STORAGE ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.

### B. INSTRUCTIONAL AREAS

#### 1. WEED CHARACTERISTICS AFFECTING CONTROL

##### A. IDENTIFYING LIFE STYLES OF WEEDS

- (1) ANNUALS
- (2) PERENNIALS
- (3) BIENNIALS

##### B. IDENTIFYING MAJOR LEAF AND STEM STRUCTURE OF WEEDS

##### C. IDENTIFYING REPRODUCTIVE SYSTEMS OF WEEDS CAUSING DAMAGE

##### D. UNDESIRABLE EFFECTS OF WEEDS IN NURSERY PLANTINGS

## 2. SELECTING AND USING VARIOUS METHODS OF WEED CONTROL

- A. MECHANICAL OR PHYSICAL METHODS OF CONTROL SUCH AS CULTIVATION
- B. USING CULTURAL METHODS SUCH AS SEEDBED TILLAGE FOR WEED CONTROL
- C. USING CHEMICAL WEED CONTROL METHODS
  - (1) DETERMINING TYPE OF HERBICIDES TO CONTROL SPECIFIC WEED PROBLEMS
    - (A) PRE-EMERGENCE
    - (B) POST-EMERGENCE
  - (2) DETERMINING TIME OF CONTROL APPLICATIONS
  - (3) SELECTING METHOD OF APPLICATION (GRANULAR OR LIQUID)
  - (4) PROCEDURES FOR SAFE HANDLING AND MIXING OF HERBICIDES
  - (5) CALIBRATING EQUIPMENT
  - (6) CLEANING PROCEDURES FOR APPLICATION EQUIPMENT

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. USING LABELS FROM HERBICIDES, HAVE STUDENTS LIST SAFETY PRECAUTIONS TO OBSERVE DURING AND AFTER APPLICATION.
 

B. EACH STUDENT SHOULD SHARPEN A HAND HOE IN ORDER TO APPRECIATE THE ADVANTAGES OF WELL-SHARPENED EQUIPMENT FOR MECHANICAL WEED CONTROL.

C. USING LABELS FROM VARIOUS HERBICIDES, STUDENT SHOULD TELL WHETHER IT IS INTENDED FOR USE AS A PRE-PLANT, PRE-EMERGENCE OR POST-EMERGENCE SPRAY AND GIVE A USE OF EACH WHEN DEALING WITH NURSERY STOCK.
2. A. USING MAGAZINE CLIPPINGS OR ACTUAL MACHINERY, STUDENTS CAN DESCRIBE ITS USE AS IT RELATED TO HERBICIDE APPLICATION, I.E., SPRAYERS, GRANULAR APPLICATORS.
 

B. EACH STUDENT OR GROUP OF STUDENTS SHOULD BE ASSIGNED SECTIONS OF VARIOUS CONTAINER PLANTS AND GIVEN RESPONSIBILITY FOR CONTROLLING WEEDS USING PHYSICAL AND CHEMICAL METHODS.
3. LET STUDENTS PRACTICE CALIBRATING VARIOUS SPRAYERS. THEY SHOULD ADJUST OR CALIBRATE THE FORWARD SPEED, PUMP PRESSURE, NOZZLE SIZE, DISTANCE OR SPACING BETWEEN NOZZLE AND HEIGHT ABOVE GROUND OF NOZZLES.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. DEVELOP A MATCHING TEST USING PICTURES OR ACTUAL WEED SPECIMENS AND HAVE STUDENTS MATCH COMMON NAMES OF WEEDS WITH THE PICTURES WITH COMPLETE ACCURACY. THE STUDENT SHOULD IDENTIFY AT LEAST FIFTY OF THE WEEDS MOST COMMON TO THE LOCAL AREA.
2. GIVE STUDENTS SPECIFIC WEED PROBLEMS FOR NURSERY CONTAINER STOCK AND HAVE THEM DETERMINE AND EXPLAIN ORALLY OR IN WRITING THE RECOMMENDED CONTROL AND THE METHOD AND PROCEDURE THAT SHOULD BE USED TO ACCOMPLISH CONTROL. THIS PROCESS SHOULD BE EVALUATED ON THE STUDENTS' ABILITY TO MAKE THE PROPER RECOMMENDATION AND LIST THE IMPORTANT POINTS TO CONSIDER IN APPLYING THE RECOMMENDED PESTICIDE.
3. EACH STUDENT SHOULD BE ABLE TO DESCRIBE AND/OR DEMONSTRATE THE PROCEDURE FOR CALIBRATING A LIQUID HERBICIDE APPLICATION WITH COMPLETE ACCURACY AND ACCORDING TO THE OPERATOR'S MANUAL.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. VARIOUS HERBICIDE CONTAINER LABELS
2. HAND AND FIELD SPRAYERS
3. HAND CULTIVATING EQUIPMENT
4. FIELD CULTIVATORS
5. VARIOUS TYPES AND KINDS OF HERBICIDES

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 288-296.

PART II OF A TWO-VOLUME SET OF REFERENCE MATERIALS DESIGNED FOR A NURSERY WORKER COURSE OF STUDY. MATERIAL COVERING WEED CONTROL INCLUDES CULTIVATION AND CHEMICAL METHODS OF CONTROL.

2. WEED CONTROL --- CULTURAL AND CHEMICAL. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1969,

A COMPREHENSIVE REFERENCE UNIT FOR ALL TYPES OF WEED CONTROL PRACTICES AND PROCEDURES WRITTEN FOR STUDENT USE.



## NURSERY DISEASE, INSECT AND PEST CONTROL

**UNIT CONCEPT:** INSECTS, DISEASES AND PESTS OF NURSERY STOCK CAN BE CONTROLLED IF CERTAIN FACTORS ARE CONSIDERED AND PROPER PROCEDURES ARE FOLLOWED BY THE NURSERY WORKER.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN PLANT SPECIMENS DAMAGED BY DISEASE, INSECTS OR PESTS, RECOGNIZE THE SOURCE OF THE DAMAGE, EITHER ON SIGHT OR USING A RECOGNIZED REFERENCE.
2. WHEN GIVEN A RECOGNIZED REFERENCE AND NURSERY STOCK SPECIMENS, DETERMINE RECOMMENDATIONS FOR CONTROL OF COMMON NURSERY PESTS.
3. WHEN GIVEN VARIOUS NURSERY PLANT SPECIMENS WITH DISEASE, INSECT, OR PEST DAMAGE, CARRY OUT RECOMMENDED PROCEDURES FOR CONTROLLING SPECIFIC PLANT PEST PROBLEMS.
4. GIVEN A NURSERY FIELD PLOT OR GROUP OF CONTAINER STOCK, IMPLEMENT A PREVENTATIVE PROGRAM FOR PEST CONTROL.

### B. INSTRUCTIONAL AREAS

1. IDENTIFYING THE INSECT LIFE CYCLES AS RELATED TO CONTROL
  - A. SELECTING THE GROWTH STAGE FOR EASIEST CONTROL
  - B. SELECTING THE EFFECTIVE CONTROL SEASON
    - (1) MID-SEASON
    - (2) WINTER SEASON
  - C. LOCATING INSECTS DURING GROWTH STAGES
    - (1) FOLIAGE
    - (2) BARK
    - (3) SOIL
2. SELECTING CONTROL MEASURES

- A. IDENTIFICATION OF INSECTS CAUSING DAMAGE
- B. PRESCRIBING EFFECTIVE CONTROL
- C. APPLYING EFFECTIVE CONTROL PROCEDURES
  - (1) LEGAL IMPLICATIONS FOR MISUSE OF CHEMICALS
  - (2) FOLLOWING SAFE PROCEDURES
- 3. DETERMINING SOURCES OF PLANT DISEASES
  - A. BACTERIA
  - B. FUNGI
  - C. VIRUSES
  - D. MYCOPLASMA
  - E. NEMATODES
  - F. NON-PATHOGENIC DISEASES
- 4. SELECTING METHODS OF PLANT DISEASE CONTROL
  - A. MECHANICAL CONTROL - KILLING INSECTS BY HAND, PRUNING
  - B. QUARANTINE CONTROL - RESTRICTING THE SPREAD OF INFESTED OR INFECTED PLANT MATERIAL
  - C. BIOLOGICAL CONTROL - ONE ORGANISM KILLING ANOTHER
  - D. CHEMICAL CONTROL - APPLYING TOXIC CHEMICALS
  - E. NATURAL CONTROL -- ADVERSE WEATHER OR OTHER ENVIRONMENTAL CONDITIONS
- 5. IDENTIFYING TYPES OF DAMAGE TO LANDSCAPE PLANTS BY RODENTS, WILDLIFE AND OTHER PESTS
  - A. BARK DAMAGE
  - B. ROOT DAMAGE
  - C. LIMB DAMAGE
- 6. CONTROLLING RODENTS, WILDLIFE, AND OTHER PEST DAMAGE
  - A. FENCING LANDSCAPE AREAS
  - B. BAITES FOR RODENTS



C. USING BARK REPELLENTS

D. TREATING WOUND DAMAGE

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. USING REFERENCES THAT DESCRIBE DISEASES IN THE LOCAL AREA, STUDENTS SHOULD IDENTIFY THE CAUSE AND RECOMMEND CONTROL MEASURES FOR VARIOUS PLANT SPECIMENS OR SLIDES OR DISEASED NURSERY PLANTS.  
  
B. HAVE STUDENTS COLLECT DISEASED OR INSECT DAMAGED SPECIMENS FROM LOCAL AREA, AND USE REFERENCES TO IDENTIFY THE CAUSE AND THE MOST APPROPRIATE CONTROL MEASURE(S) TO USE TO ELIMINATE OR CONTROL THE PROBLEM.
2. STUDENTS SHOULD STUDY THE LIFE CYCLES OF COMMON INSECT PESTS FOUND IN NURSERIES TO DETERMINE THE BEST TIME AND METHOD OF CONTROL.
3. GIVE STUDENTS SPECIFIC PLANT INSECT AND DISEASE "PROBLEMS" AND HAVE THEM USE REFERENCES TO DETERMINE THE MOST APPROPRIATE CONTROL PROCEDURES FOR CARRYING OUT THE RECOMMENDATIONS.
4. STUDENTS MAY SET UP A PREVENTATIVE CONTROL PROGRAM FOR DISEASES, INSECTS AND OTHER PESTS FOR THE SCHOOL OR COOPERATIVE WORK EXPERIENCE STATION USING RECOGNIZED REFERENCES.

### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. DEVELOP A MATCHING TEST AND HAVE STUDENTS MATCH NAMES OF INSECTS AND DISEASES OF NURSERY PLANTS WITH PICTURES OR SLIDES OF DAMAGED PLANT SPECIMENS. THIS EXERCISE SHOULD BE COMPLETED WITH COMPLETE ACCURACY WITH DISEASES, INSECTS AND PESTS COMMON TO THE LOCAL AREA.
2. GIVE STUDENTS SUFFICIENT REFERENCES AND VARIOUS NURSERY SPECIMENS DAMAGED BY INSECTS, DISEASES, OR PESTS, AND HAVE EACH STUDENT TO DETERMINE THE MOST APPROPRIATE METHOD OF CONTROL FOR EACH WITH COMPLETE ACCURACY.

3. EACH STUDENT SHOULD LIST AND EXPLAIN THE SAFETY PRECAUTIONS ONE MUST FOLLOW WHEN APPLYING CHEMICALS TO CONTROL INSECTS AND DISEASES. THIS LIST SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) READING LABEL DIRECTIONS, (2) WEARING PROTECTIVE CLOTHING, (3) PROPER TIME OF APPLICATION, (4) CONSIDERING WEATHER CONDITIONS DURING APPLICATION, (5) CLEANING APPLICATORS ACCORDING TO LABEL AND MANUFACTURER'S RECOMMENDATIONS.
4. GIVE EACH STUDENT A SPECIFIC GROUP OF NURSERY PLANTS AND HAVE THEM OUTLINE THE FACTORS TO CONSIDER WHEN DEVELOPING A PREVENTATIVE CONTROL PROGRAM FOR INSECTS AND DISEASES. THIS OUTLINE SHOULD INCLUDE: (1) IDENTIFYING POTENTIAL DISEASE, INSECT, AND PEST PROBLEMS, (2) METHODS OF CONTROL, (3) TIME OF APPLICATION, AND (4) PLANT GROWTH STAGES MOST APPROPRIATE FOR APPLICATION TO ACHIEVE EFFECTIVE CONTROL.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. PLANT SPECIMENS, SLIDES, FILMSTRIPS OR PICTURES SHOWING VARIOUS INSECT, DISEASE OR PEST DAMAGE.
2. REFERENCES OUTLINING CONTROL MEASURES FOR COMMON LOCAL INSECTS, DISEASES OR PESTS.

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. THE NURSERY WORKER, PART II. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1971, PP. 243-288.

PART II OF A TWO VOLUME SET OF REFERENCE MATERIALS FOR A NURSERY WORKER COURSE OF STUDY. MATERIAL COVERED IN PART II DEALS WITH PEST CONTROL (DISEASES AND INSECTS) WHICH WOULD BE HELPING IN ACHIEVING THE OBJECTIVE OF THIS UNIT.

2. ORNAMENTAL HORTICULTURE FOR VOCATIONAL AGRICULTURE IN ALABAMA. MONTGOMERY, ALABAMA: AGRIBUSINESS EDUCATION SERVICE, STATE DEPARTMENT OF EDUCATION. 1971, 349 PP.

A COMPREHENSIVE REFERENCE FOR THE STUDENT OR TEACHER IN ORNAMENTAL HORTICULTURE COVERING ALL AREAS OF THE TAXONOMY INCLUDING NURSERY, FLORAL CROP PRODUCTION, GREENHOUSE CONSTRUCTION, LANDSCAPE DESIGN, TURF CARE, AND MERCHANDISING HORTICULTURAL PLANTS AND SUPPLIES. A STUDENT STUDY GUIDE IS ALSO AVAILABLE.

3. STATE DEPARTMENT OF AGRICULTURE PUBLICATIONS AND COOPERATIVE EXTENSION BULLETINS SHOULD BE ACQUIRED DEALING WITH IDENTIFICATION AND CONTROLLING SPECIFIC DISEASES, INSECTS AND PESTS IN THE LOCAL AREA. THESE SHOULD ALSO CONTAIN INFORMATION ABOUT LEGAL RESTRICTIONS FOR CHEMICALS USED FOR CONTROLLING PESTS.

## SAFE USE OF PEST CONTROL CHEMICALS

**UNIT CONCEPT:** PESTICIDES CAN BE VERY BENEFICIAL TO THE NURSERY-MAN FOR CONTROLLING PESTS, IF USED PROPERLY; HOWEVER, PROFICIENCY MUST BE DEVELOPED WHEN HANDLING, MIXING AND STORING PEST CONTROL CHEMICALS IN ORDER TO PREVENT THE HARMFUL EFFECTS ON HUMANS, ANIMALS AND OTHER PLANT LIFE.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN LABELS FROM VARIOUS COMMONLY USED PESTICIDES, DETERMINE TYPE OF PEST(S) THAT THE PESTICIDE IS DESIGNED TO CONTROL.
2. WHEN GIVEN VARIOUS COMMONLY USED PESTICIDES, DEMONSTRATE THE RECOMMENDED PROCEDURE AND SAFETY PRECAUTIONS FOR HANDLING AND MIXING PESTICIDES.
3. WHEN GIVEN VARIOUS PESTICIDES READY FOR APPLICATION, DEMONSTRATE THE PROCEDURES FOR SAFE APPLICATION OF PESTICIDES.
4. WHEN GIVEN SURPLUS PESTICIDES AND CONTAINER, DEMONSTRATE THE PROCEDURE FOR SAFE DISPOSAL AND STORAGE OF PESTICIDES.
5. WHEN GIVEN VARIOUS COMMONLY USED PESTICIDES, DETERMINE AND FOLLOW LEGAL RESTRICTIONS AS THEY PERTAIN TO THE HANDLING, MIXING, STORAGE AND DISPOSAL OF PESTICIDES.

### B. INSTRUCTIONAL AREAS

#### 1. CLASSIFYING PESTICIDES

- A. IDENTIFYING TYPE OF PEST TO BE CONTROLLED BY PESTICIDE
- B. CLASSIFYING ACCORDING TO PESTICIDE METHOD OF CONTROL
  - (1) CONTACT
  - (2) STOMACH
  - (3) SYSTEMIC

- C. CLASSIFYING ACCORDING TO TYPE OF FORMULATION
- 2. HANDLING AND MIXING PESTICIDES SAFELY
  - A. FOLLOWING LABEL DIRECTIONS FOR PROPER AND SAFE HANDLING
  - B. DETERMINING IF PROTECTIVE CLOTHING IS NEEDED
  - C. DETERMINING LEGAL RESTRICTIONS FOR HANDLING AND MIXING PESTICIDES
  - D. FOLLOWING SAFETY PRECAUTIONS WHEN MIXING PESTICIDES
- 3. APPLYING PESTICIDES ACCURATELY AND SAFELY
  - A. DETERMINING APPLICATION RATES
  - B. CONSIDERING ENVIRONMENTAL CONDITIONS IN RELATION TO APPLICATION (WIND, ETC.)
  - C. CALIBRATING APPLICATION EQUIPMENT ACCURATELY
  - D. LEGAL RESTRICTIONS TO BE FOLLOWED IN APPLYING PESTICIDES
  - E. FOLLOWING RECOMMENDED PROCEDURES FOR ACCURATE AND SAFE APPLICATION
  - F. CLEANING EQUIPMENT ACCORDING TO LABEL AND MANUFACTURER'S RECOMMENDATIONS
- 4. DISPOSING OF SURPLUS PESTICIDES AND CONTAINERS
  - A. NEUTRALIZING POISONOUS EFFECTS
  - B. BURYING SURPLUS PESTICIDES AND CONTAINERS
  - C. DISPOSING OF EMPTY CONTAINERS
  - D. AVOIDING PESTICIDE CONTACT DURING DISPOSAL
  - E. WASHING LARGE CONTAINERS
- 5. STORING PESTICIDES
  - A. DETERMINING POSSIBLE CONSEQUENCES OF IMPROPER STORAGE
  - B. PROVIDING PROPER STORAGE CONDITIONS
  - C. AFFIXING LOOSE LABELS ON CONTAINERS

- D. DISCARDING OUTDATED AND UNIDENTIFIED CONTAINERS AND MATERIALS
- E. EXAMINING CONTAINERS PERIODICALLY FOR LEAKS AND TEARS
- F. PRECAUTIONS AGAINST POTENTIAL FIRE HAZARDS

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. OBTAIN A LIST OF COMMONLY USED PESTICIDES AND SUFFICIENT REFERENCES AND HAVE STUDENTS MAKE A CHART FOR FUTURE USE WHICH DETAILS THE NAME OF THE PESTICIDES, TYPE, CHEMICAL NATURE OR SOURCE, AVAILABLE FORMULATIONS, CROPS WHERE COMMONLY USED AND TYPE OF PEST CONTROLLED.
2. USING VARIOUS PESTICIDE LABELS, HAVE STUDENTS GIVE ALL PRECAUTIONARY MEASURES TO BE OBSERVED WHEN USING A PARTICULAR SUBSTANCE.
3. A. DEPENDING ON TYPE OF EQUIPMENT AVAILABLE, HAVE STUDENTS DEMONSTRATE THE SAFEST PROCEDURE TO FOLLOW WHEN USING PARTICULAR PESTICIDES. EACH STUDENT SHOULD PERFORM THIS TASK WITH AT LEAST THREE DIFFERENT KINDS OF PESTICIDES.  
  
B. STUDENT CAN DEMONSTRATE PROPER CLEANING PROCEDURES FOR AVAILABLE SPRAYERS.  
  
C. STUDENTS SHOULD CALIBRATE EQUIPMENT TO ACHIEVE MOST EFFECTIVE AND SAFEST APPLICATION OF PEST CONTROL CHEMICALS.
4. A. HAVE STUDENTS MAKE SAFETY SURVEY OR CHECK AT HOME FOR POSSIBLE HAZARDOUS CONDITIONS RELATING TO PESTICIDE STORAGE.  
  
B. STUDENTS MAY DISPOSE OF EMPTY CONTAINERS FOLLOWING RECOMMENDED PROCEDURES.
5. WITH THE MOST COMMONLY USED PESTICIDES, HAVE STUDENTS DETERMINE AND LIST ANY LICENSES, PERMITS OR OTHER LEGAL RESTRICTIONS AS THEY PERTAIN TO THE ACQUISITION, HANDLING, MIXING, APPLICATION OR STORAGE OF THE PESTICIDES.

### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. DEVELOP A MATCHING TEST OR EXERCISE WHICH LISTS THE TYPE OF PESTICIDE IN ONE COLUMN AND THE PEST TO BE

CONTROLLED IN THE OTHER AND HAVE STUDENTS MATCH THE PROPER PEST WITH THE TYPE OF PESTICIDE WITH COMPLETE ACCURACY.

2. WITH PESTICIDE LABELS OR SIMILAR INFORMATION, THE STUDENT SHOULD BE ABLE TO DETERMINE, DESCRIBE OR DEMONSTRATE THE RECOMMENDED PROCEDURE FOR MIXING THE PARTICULAR PESTICIDE FOR A SPECIFIC CROP WITH COMPLETE ACCURACY.
3. EACH STUDENT SHOULD LIST AND EXPLAIN THE SAFETY PRECAUTIONS ONE MUST FOLLOW WHEN APPLYING CHEMICALS TO CONTROL PESTS. THIS LIST SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) READING LABEL DIRECTIONS, (2) WEARING PROTECTIVE CLOTHING, (3) CONSIDERING ENVIRONMENTAL CONDITIONS, AND (4) PROPER CLEANING PROCEDURES FOR SAFETY.
4. WHEN GIVEN A LIST OF TYPES OF CONTAINERS AND SURPLUS PESTICIDES, THE STUDENT SHOULD DESCRIBE IN WRITING OR ORALLY WITH COMPLETE ACCURACY THE RECOMMENDED PROCEDURE FOR SAFE DISPOSAL OR STORAGE OF THE LISTED ITEMS. THESE PRECAUTIONS WILL VARY ACCORDING TO TYPE OF PESTICIDES AS WELL AS TYPE AND SIZE OF CONTAINER.
5. STUDENTS SHOULD BE ABLE TO DETERMINE THE LEGAL RESTRICTIONS FOR SPECIFIC PESTICIDE MATERIALS FOR THE PARTICULAR STATE OR LOCAL AREA. THEY SHOULD ALSO BE ABLE TO EXPLAIN WHY A PESTICIDE MAY BE RESTRICTED. THEIR EXPLANATION SHOULD INCLUDE: (1) HIGH RESIDUAL ACTION, (2) TOXICITY TO HUMANS OR OTHER WARM-BLOODED ANIMALS, AND (3) POISONOUS TO POLLINATING INSECTS, BIRDS OR OTHER WILDLIFE.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. LABELS FROM VARIOUS PESTICIDE CONTAINERS
2. SPRAYERS --- IF LARGE TANK SPRAYERS ARE NOT AVAILABLE, THE BASIC SAFETY PROCEDURES CAN BE FOLLOWED USING HAND SPRAYERS
3. VARIOUS PESTICIDES COMMONLY USED IN LOCAL AREA
4. LAWS OR OTHER LEGAL PAPERS PERTAINING TO PESTICIDES USED IN LOCAL AREA

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. INSECTICIDES. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, 49 PAGES.

AN EXCELLENT AND COMPREHENSIVE REFERENCE WHICH INCLUDES MATERIAL COVERING HOW PESTICIDES CONTROL PESTS, CHEMICAL NATURE OF INSECTICIDES, LABEL INFORMATION, LEGISLATION PERTAINING TO PESTICIDE USE, APPLICATOR STORAGE, AND DISPOSAL OF PESTICIDES.



## VI

**TURFGRASS MAINTENANCE AND ESTABLISHMENT**  
**U.S.O.E. CODE 01.05 06 00 00**

**SELECTING TURFGRASSES FOR NEW PLANTINGS**

**TURF SITE PREPARATION**

**TURF ESTABLISHMENT BY SEEDING AND VEGETATIVELY PLANTING**

**MOWING TURF AREAS**

**MAINTAINING TURF FERTILITY**

**WATERING TURF AREAS**

**TURF WEED CONTROL**

**TURF DISEASE, INSECT AND ANIMAL PEST CONTROL**

**SAFE USE OF PEST CONTROL CHEMICALS**

**RENOVATING OLD TURF AREAS**

## SELECTING TURFGRASSES FOR NEW PLANTINGS

**UNIT CONCEPT:** SELECTION OF THE BEST TURFGRASSES FOR SPECIFIC USES REQUIRES A WORKING KNOWLEDGE OF GROWTH HABITS AND THE CONDITIONS TO WHICH THE TURF WILL BE SUBJECTED. THE TURF WORKER MUST BE ABLE TO IDENTIFY AND SELECT TURFGRASS VARIETIES ADAPTED TO THE ENVIRONMENTAL CONDITIONS INTENDED FOR USE OF THE TURF AREAS AND MANAGEMENT PRACTICES TO INSURE ESTABLISHMENT AND DEVELOPMENT OF HIGH QUALITY PRODUCTIVE TURFGRASSES.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN AN ESTABLISHED TURF AREA, IDENTIFY THE TURFGRASSES GROWING IN THE AREA.
2. WHEN GIVEN A LIST OR GROUP OF AVAILABLE TURFGRASS VARIETIES AND THE INTENDED USE OF A PARTICULAR TURF AREA, SUCH AS GOLF GREENS AND LAWNS, SELECT THE SPECIES OR VARIETIES THAT BEST MEET THE INTENDED USE OF THE AREA AND WILL RESULT IN PRODUCTIVE GROWTH UPON ESTABLISHMENT.
3. WHEN GIVEN A SET OF MANAGEMENT PRACTICES FOR A TURF AREA AND AVAILABLE TURFGRASSES, SELECT THE MOST APPROPRIATE VARIETIES FOR ESTABLISHMENT THAT WILL WITHSTAND THE MANAGEMENT PRACTICES AS WELL AS BE PRODUCTIVE.
4. WHEN GIVEN A SET OF ENVIRONMENTAL AND SOIL CONDITIONS FOR A SPECIFIC TURF AREA, SELECT THE MOST APPROPRIATE SPECIES OR MIXTURES OF TURFGRASS(ES) TO USE TO MEET THE GIVEN CONDITIONS.

### B. INSTRUCTIONAL AREAS

#### 1. GENERAL CONSIDERATIONS OF SELECTION

##### A. DETERMINING INTENDED USE OF TURF AREA

- (1) GOLF COURSE
- (2) LAWN
- (3) PARK
- (4) RECREATIONAL AREA (ATHLETIC FIELD, ETC.)

**B. DETERMINING ENVIRONMENTAL CONDITIONS WHICH RELATE TO SELECTION**

- (1) GROWING SEASON**
- (2) RAINFALL**
- (3) TEMPERATURE**
- (4) SHADE**

**C. IDENTIFYING SOIL CONDITIONS AFFECTING SELECTION**

- (1) DRAINAGE**
- (2) FERTILITY**
- (3) SOIL TYPE**
- (4) SLOPE**

**2. IDENTIFYING GRASS SPECIES AND VARIETAL CHARACTERISTICS AFFECTING SELECTION**

- A. RATE OF ESTABLISHMENT**
- B. DISEASE TOLERANCE**
- C. TEXTURE OF ESTABLISHED GRASS**
- D. SHADE TOLERANCE**
- E. WEAR RESISTANCE**
- F. DROUGHT TOLERANCE**
- G. FERTILITY NEEDS OF SPECIFIC MIXTURES**
- H. TOLERANCE TO SPECIFIC MANAGEMENT PRACTICES**

**3. SELECTING GRASSES FOR LAWNS**

- A. IDENTIFYING DESIRABLE SEED MIXTURES FOR THE AREA**
- B. DETERMINING COST IN RELATION TO QUALITY PRODUCTIVITY**
- C. RECOGNIZING IMPORTANCE OF CERTIFIED SEED**
- D. SELECTING FOR INTENDED MANAGEMENT LEVEL**

**4. SELECTING GRASSES FOR GOLF COURSES**

- A. IDENTIFYING TURFGRASS MIXTURES FOR TEES**
- B. SELECTING TURFGRASSES FOR FAIRWAYS**
- C. ROUGHS AND TRAP SHOULDER SPECIES COMMONLY USED**

### **5. SELECTING GRASSES FOR ATHLETIC FIELDS AND PARKS**

- A. IDENTIFYING VARIETIES RESISTANT TO HEAVY USE**
- B. SELECTING SHADE-RESISTANT VARIETIES FOR PARK AREAS**
- C. SELECTING VARIETIES RESISTANT TO CLOSE MOWING AND HEAVY USE**

### **C. EXAMPLES OF STUDENT LEARNING ACTIVITIES**

- 1. USING SEED SAMPLES AND SAMPLES OF GROWING TURFGRASSES, HAVE STUDENTS IDENTIFY THE SPECIES BY COMMON NAME AND GIVE A TURF AREA WHERE THE VARIETY MAY BE USED.**
- 2. VISIT A GOLF COURSE TO SEE THE TYPE OF TURF NEEDED FOR SPECIFIC AREAS AND HAVE THEM IDENTIFY THE CONDITIONS THAT TURFGRASSES IN THESE AREAS MUST MEET.**
- 3. HAVE STUDENTS RECOMMEND TURFGRASSES FOR SPECIFIC AREAS USING LANDSCAPE PLANS AND BULLETINS RECOMMENDING VARIETIES FOR LOCAL AREA.**
- 4. HAVE STUDENTS ANALYZE SEED TAGS FOR CONTENT AND THEN HAVE THEM GIVE THE ADVANTAGES AND DISADVANTAGES OF THE VARIETY OR MIXTURE FOR SPECIFIC SITUATIONS.**

### **D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE**

- 1. USING SLIDES, PICTURES, OR ACTUAL TURF SPECIMENS WHICH ILLUSTRATE OR CONTAIN THE COMMON TURFGRASS SPECIES AND VARIETIES, HAVE EACH STUDENT IDENTIFY THE SPECIES OR VARIETY SHOWN WITH 100% ACCURACY.**
- 2. DEVELOP A MATCHING TEST AND IN ONE COLUMN LIST THE NAMES OF VARIOUS TURF AREAS SUCH AS GOLF GREENS, LAWNS, TEES, AND ATHLETIC FIELD AND HAVE STUDENTS MATCH THESE AREAS WITH A LIST OF TURFGRASS SPECIES AND VARIETIES AVAILABLE. THIS ACTIVITY SHOULD BE ACCOMPLISHED WITH 95% ACCURACY.**
- 3. DEVELOP A SERIES OF STATEMENTS WHICH DETAIL VARIOUS MANAGEMENT PRACTICES FOR TURF AREAS AND THEN GIVE STUDENTS A LIST OF VARIOUS TURFGRASSES. EACH STUDENT SHOULD THEN INDICATE THE TURFGRASSES THAT CAN "WITHSTAND" OR "NOT WITHSTAND" THE VARIOUS MANAGEMENT PRACTICES WITH 90% ACCURACY.**
- 4. HAVE STUDENTS LIST THE ENVIRONMENTAL AND SOIL CONDITIONS THAT WILL AFFECT THE SELECTION OF TURFGRASSES. THIS LIST SHOULD INCLUDE: GROWING SEASON, RAINFALL, TEMPERATURE, AMOUNT OF SHADE, DRAINAGE, FERTILITY, SOIL TYPE AND SLOPE OF TURF AREA.**

**E. INSTRUCTIONAL MATERIALS OR EQUIPMENT**

1. SAMPLES OF VARIOUS GRASS SEEDS
2. SAMPLES OF VARIOUS LIVE-GRASS SPECIES AND/OR DRIED SPECIMENS
3. LABELS FROM GRASS MIXTURES
4. LANDSCAPE PLANS - THESE MAY BE SIMPLE DRAWINGS WITH DESCRIPTIONS OF USE AND TYPES OF TURF AREA NEEDED.

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. STATE DEPARTMENT OF AGRICULTURE AND COOPERATIVE EXTENSION BULLETINS SHOULD BE ACQUIRED FOR RECOMMENDED SPECIES AND MIXTURES FOR LOCAL AREA.
2. TURFGRASS MAINTENANCE AND ESTABLISHMENT. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 132-136.

A COMPREHENSIVE REFERENCE MANUAL WHICH INCLUDES DISCUSSION OF SELECTING TURFGRASS VARIETIES FOR VARYING TURF AREAS AS WELL AS OTHER ESTABLISHMENT AND MAINTENANCE CONTENT.

3. TURF MANAGEMENT. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, PP. 50-53.

A COMPREHENSIVE REFERENCE MANUAL WHICH INCLUDES MATERIAL ON TURF SOIL, DRAINAGE, TURFGRASS SPECIES AND VARIETIES, PROPAGATION AND TURF MAINTENANCE, INCLUDING PEST CONTROL.

## **TURF SITE PREPARATION**

**UNIT CONCEPT:** TURF SITE PREPARATION IS A VERY IMPORTANT OPERATION FOR THE TURFGRASS WORKER. WITHOUT THE PROPER CONDITIONS FOR ESTABLISHMENT AND CONTINUED GROWTH OF TURFGRASS, THE TURF AREA WILL NOT BE PRODUCTIVE, ATTRACTIVE OR MANAGEABLE.

### **A. STUDENT PERFORMANCE OBJECTIVES**

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A PLANNED TURF SITE, RECOGNIZE AREAS WHICH INDICATE A NEED FOR SUB-SURFACE DRAINAGE TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER.
2. WHEN GIVEN A ROUGH GRADED TURF SITE WITH ADEQUATE SUB-SURFACE DRAINAGE, PERFORM THOSE OPERATIONS NECESSARY TO PROVIDE FOR SURFACE DRAINAGE OF THE TURF SITE.
3. WHEN GIVEN A ROUGH GRADED AND DRAINED TURF AREA, PREPARE THE SEEDBED SOIL SURFACE BY USING SMALL ENGINE POWERED OR TRACTOR-DRIVEN TILLAGE EQUIPMENT ACCORDING TO RECOMMENDED PROCEDURES.
4. WHEN GIVEN A GRADED AND DRAINED TURF AREA, APPLY LIME AND FERTILIZER AS RECOMMENDED BY SOIL TEST RESULTS AND INCORPORATE THESE MATERIALS INTO THE SOIL TO ASSURE MEETING NUTRIENT NEEDS OF THE GRASSES TO BE PLANTED.

### **B. INSTRUCTIONAL AREAS**

1. RECOGNIZING SUB-SURFACE DRAINAGE PROBLEMS
  - A. IDENTIFYING SOIL COLOR OF SUB-SURFACE
  - B. SOIL TYPE AS RELATED TO INTERNAL DRAINAGE
  - C. DETERMINING SLOPE OF TURF AREA
  - D. ANALYZING LENGTH OR DURATION OF SURFACE STANDING WATER

## **2. SURFACE GRADING OF TURF AREAS**

- A. RELOCATING SOIL**
- B. MAINTAINING UNIFORM DEPTH OF TOP SOIL**
- C. ADJUSTING SLOPE OF PLANNED TURF AREAS**

## **3. PREPARING TURF SEEDBEDS**

- A. FITTING OPERATIONS SUCH AS TILLAGE**
- B. REMOVING STONES AND OTHER DEBRIS**
- C. PASTEURIZING SOIL TO ELIMINATE PESTS**
- D. APPLYING LIME AND FERTILIZER TO SEEDBEDS**
- E. INCORPORATING STARTER FERTILIZERS**

## **C. EXAMPLES OF STUDENT LEARNING ACTIVITIES**

- 1. PLAN A TOUR OF LOCAL HOMES WHERE PREPARATIONS ARE BEING MADE TO ESTABLISH LAWNS TO EXAMINE THE GRADING AND DRAINAGE PRACTICES BEING USED.**
- 2. HAVE STUDENTS VISIT A GOLF COURSE FOR A STUDY OF GOLF COURSE SEEDBEDS AND ESTABLISHED TURF TO SEE THE VARIATION IN PREPARATION PROCEDURES FOR GREENS, FAIRWAYS, ETC.**
- 3. IF A PLANNED TURF AREA IS AVAILABLE, HAVE STUDENTS PREPARE AN ASSIGNED SECTION FOR SEEDING.**
- 4. A. EXAMINE SAMPLES OF FERTILIZERS NOTING THE PHYSICAL FORM AND DISCUSS GRADE, COMPOSITION, COST PER POUND OF PLANT FOOD, COMBINATIONS OF PLANT FOOD AND COMBINATIONS OF FERTILIZER AND PESTICIDES.**  
**B. HAVE STUDENTS TAKE SOIL SAMPLES FOR ANALYSES AND APPLY LIME AND FERTILIZERS ACCORDING TO TEST RESULTS TO A GIVEN TURF AREA.**

## **D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE**

- 1. USING SOIL PROFILES AND SOIL SAMPLES, HAVE STUDENTS INDICATE WHICH ONES WILL REQUIRE SUB-SURFACE DRAINAGE IF USED AS A TURF AREA.**

2. EACH STUDENT SHOULD LIST (IN PROPER SEQUENCE) THE PROCEDURES HE OR SHE SHOULD FOLLOW IN ORDER TO PROVIDE FOR ADEQUATE SURFACE DRAINAGE OF "GIVEN" TURF SITES. THIS LIST SHOULD INCLUDE RELOCATING SOIL FOR PROPER SLOPE, AND MAINTAINING PROPER DEPTH OF TOP SOIL.
3. ASSIGN A SMALL PLOT OF GROUND (TURF SITE) TO EACH STUDENT AND HAVE THEM DEMONSTRATE THE PROPER PROCEDURE FOR PREPARING THE SOIL SURFACE FOR A SEEDBED. THIS PROCESS MAY BE DONE WITH ROTO-TILLERS AND HAND TOOLS AND SHOULD BE EVALUATED BY THE INSTRUCTOR FOR PROPER DEPTH OF TOP SOIL, AND THE AREA SHOULD BE FREE OF STONES AND DEBRIS.
4. HAVE EACH STUDENT TO CALIBRATE A FERTILIZER OR LIME SPREADER FOR A SPECIFIC AMOUNT OF TURF SITE AREA WITH 95% ACCURACY.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. RAKES, HOES AND SHOVELS FOR SEEDBED PREPARATION
2. VARIOUS TYPES OF TILE FOR ILLUSTRATION PURPOSES
3. FERTILIZERS
4. SOIL TEST KITS
5. POWER EQUIPMENT SUCH AS TILLERS, SPREADERS, ETC., FOR LARGE TURF AREAS

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. TURFGRASS MAINTENANCE AND ESTABLISHMENT. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 115-120, 122-132.

THIS REFERENCE SHOULD BE OF VALUE FOR THE OBJECTIVES OF THIS UNIT. MATERIAL COVERED INCLUDES DRAINAGE, FERTILIZATION, AND SEEDBED PREPARATION.

2. TURF MANAGEMENT. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, PP. 21-35, 59-61.

A COMPREHENSIVE REFERENCE MANUAL WHICH INCLUDES MATERIAL ON TURF SOIL, DRAINAGE, TURFGRASS SPECIES AND VARIETIES, PROPAGATION AND TURF MAINTENANCE, INCLUDING PEST CONTROL.



## TURF ESTABLISHMENT BY SEEDING AND VEGETATIVELY PLANTING

**UNIT CONCEPT:** TURFGRASS AREAS ARE PLANTED EITHER FROM SEED OR BY VEGETATIVE METHODS (SOD) DEPENDING UPON THE TYPE OF TURF NEEDED AND HOW QUICKLY THE AREA NEEDS TO BE ESTABLISHED. THE TURF WORKER MUST BECOME PROFICIENT IN BOTH OF THESE PROCEDURES IN ORDER TO USE THE MOST APPROPRIATE METHOD FOR A GIVEN TURF AREA.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A PREPARED TURF SITE, DEMONSTRATE PROPER SEEDING PROCEDURES FOR ESTABLISHING A PRODUCTIVE AND MANAGEABLE TURF.
2. WHEN GIVEN AN AREA TO BE SODDED, DEMONSTRATE THE PROPER PROCEDURE FOR REMOVING SOD FROM ESTABLISHED SOD PRODUCING AREAS AND TRANSPLANTING THE SOD IN A PREPARED TURF SITE.
3. WHEN GIVEN A COMMONLY USED MULCHING MATERIAL, DEMONSTRATE THE PROPER METHOD OF MULCHING A NEWLY SEEDED TURF AREA TO INSURE IMPROVED ESTABLISHMENT.
4. WHEN GIVEN A PREPARED TURF SITE, DEMONSTRATE THE PROPER METHOD OF VEGETATIVE TURF ESTABLISHMENT BY STOLONIZING.

### B. INSTRUCTIONAL AREAS

#### 1. SEEDING PRACTICES FOR TURFGRASS

- A. DETERMINING THE BEST TIME OF SEEDING FOR VARIETY, USE OF AREA, AND ENVIRONMENTAL CONDITION
- B. DETERMINING PROPER SEEDING RATE
- C. SEEDING PROCESSES
  - (1) DISTRIBUTING SEED
  - (2) COVERING SEED
  - (3) MULCHING SEEDED AREA

- (A) SELECTING MULCHING MATERIALS
- (B) METHODS OF APPLICATION

- (4) ROLLING MULCHED AREA
- (5) WATERING PROCESSES

## 2. ESTABLISHMENT OF TURF AREAS BY SODDING

### A. SOURCES OF SOD

### B. DETERMINING WHEN TO SOD

### C. LIFTING SOD FOR TRANSPLANTING

- (1) TYPES OF CUTTERS COMMONLY USED
- (2) LIFTING WITH HAND TOOLS
- (3) ASSURING UNIFORM THICKNESS OF SOD WHEN CUT (LIFTED) BY HAND TOOLS
- (4) TRIMMING TECHNIQUES FOR HAND CUT SOD

### D. SOD LAYING PROCESSES

- (1) PROVIDING A FIRM SEEDBED SURFACE FOR SODDING
- (2) LAYOUT OF AREA
- (3) ROLLING PROCEDURES
- (4) IRRIGATING FOR MOISTURE REQUIREMENTS

## 3. ESTABLISHING TURF AREAS BY STOLONS

### A. ACQUIRING FRAGMENTED STOLONS FROM COMMERCIAL SOURCES

### B. DETERMINING METHODS OF PLANTING AND PROCEDURES FOR USE

- (1) MACHINE DISTRIBUTION
- (2) HYDROSTOLONIZING

### C. ROLLING AND TOP DRESSING WITH SOIL PLANTED STOLONS

### D. PROVIDING MOISTURE REQUIREMENTS OF PLANTED STOLONS

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. ON A PREPARED SEEDBED, HAVE STUDENTS SEED TURF AREA. THEY SHOULD DETERMINE BEST TIME TO PLANT, PROPER SEEDING RATE, AS WELL AS DEMONSTRATE THE PROPER PROCESSES TO USE.
2. A. VISIT A SOD NURSERY TO OBSERVE A SOD-LIFTING OPERATION. HAVE STUDENTS OBSERVE AND STUDY:

- (1) OPERATION AND ADJUSTMENT OF CUTTER
- (2) MEASUREMENT OF SOD THICKNESS
- (3) TRANSPORTATION OF SOD TO TURF SITE

B. HAVE STUDENT ADJUST AND OPERATE AVAILABLE SOD CUTTERS

C. HAVE STUDENTS TRANSPLANT SOD ON AN AREA NEEDING ESTABLISHMENT. THEY SHOULD HAVE PREVIOUSLY PREPARED A QUALITY SURFACE FOR PLANTING AND SHOULD BE RESPONSIBLE FOR LAYOUT OF THE AREA AND ROLLING AFTER THE SOD IS LAID.

3. STUDENTS SHOULD IDENTIFY MULCHING MATERIALS THAT CAN BE USED FOR NEWLY ESTABLISHED AREAS AND PRACTICE MULCHING PLANTED AREAS.

4. A. HAVE STUDENTS ESTABLISH A SMALL TURF AREA BY STOLONIZING, IF POSSIBLE. IF AREA IS NOT AVAILABLE, VISIT A SITE WHERE THIS OPERATION IS CARRIED OUT, SUCH AS A GOLF COURSE.

B. SHOW SLIDES OF WELL SEEDED, STOLONIZED AND SODDED AREAS AND COMPARE WITH POORLY ESTABLISHED SITES.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. EACH STUDENT SHOULD LIST AND EXPLAIN OR DEMONSTRATE THE STEPS THAT ARE ESSENTIAL FOR SEEDING A PREPARED TURF SITE. THIS LISTING OR DEMONSTRATION SHOULD INCLUDE THE FOLLOWING: (1) DETERMINING SEEDING RATE, (2) SOWING SEEDS, (3) COVERING SEED, (4) MULCHING SEEDED AREAS, (5) ROLLING, AND (5) WATERING SEEDED AREAS.
2. DEVELOP A MATCHING TEST WITH TYPES OF SOD SUCH AS BENTGRASSES AND BLUEGRASS IN ONE COLUMN AND VARIOUS THICKNESSES IN THE OTHER AND HAVE STUDENTS MATCH THE SOD VARIETIES WITH THE MOST APPROPRIATE THICKNESS FOR CUTTING SOD FOR TRANSPLANTING. THIS ACTIVITY SHOULD BE ACCOMPLISHED WITH 100% ACCURACY FOR THE COMMONLY USED TURF VARIETIES.
3. EACH STUDENT SHOULD LIST OR DESCRIBE ORALLY THE TECHNIQUE FOR MULCHING A NEWLY SEEDED AREA. THIS DESCRIPTION SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) MOISTEN MULCH 24 TO 48 HOURS BEFORE APPLICATION(S) (2) APPLY MULCH "TWO STRAWS" THICK, (3) APPLY FIFTY POUNDS OF STRAW PER ONE-THOUSAND SQUARE FEET OF AREA, AND (4) COVER MULCH IF EROSION MAY BE A PROBLEM.

4. USING PICTURES OF TURF AREAS ESTABLISHED BY STOLONS, HAVE STUDENTS INDICATE THOSE AREAS THAT HAVE BEEN ESTABLISHED USING IMPROPER TECHNIQUES AND DESCRIBE THE PROCEDURE(S) THAT WERE NOT CONDUCTED PROPERLY. BOTH OF THESE ACTIVITIES SHOULD BE ACCOMPLISHED WITH 90% ACCURACY.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. SEEDERS
2. SOD-CUTTING EQUIPMENT
3. MULCHING MATERIALS
4. ROLLERS
5. HAND TOOLS FOR LIFTING SOD
6. WATERING EQUIPMENT

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. TURFGRASS MAINTENANCE AND ESTABLISHMENT, A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 137-143.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS DEVELOPED IN ORNAMENTAL HORTICULTURE WHICH INCLUDES TECHNICAL CONTENT NECESSARY FOR ESTABLISHING TURF AREAS BY SEEDING AND VEGETATIVE PLANTINGS.

2. TURF MANAGEMENT. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, PP. 61-68.

MANUAL'S SECTION ON TURF PROPAGATION PROVIDES A GOOD SOURCE OF EASILY UNDERSTOOD INFORMATION FOR THIS UNIT.

## MOWING TURF AREAS

**UNIT CONCEPT:** PROPER MOWING PREVENTS WEED AND DISEASE INVASION, ENHANCES THE BEAUTY OF THE AREA AND HELPS TO MAINTAIN THE TURF ACCORDING TO ITS INTENDED USE. THE TURF WORKER MUST BE ABLE TO PERFORM THOSE TECHNIQUES AND PROCEDURES TO ASSURE AN ATTRACTIVE AND FUNCTIONAL TURF AREA.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A SPECIFIC TYPE OF TURF AREA (LAWN, FAIRWAY, GOLF GREEN, ETC.), SELECT THE EQUIPMENT NEEDED TO MOW THE TURF AREA ACCORDING TO ITS INTENDED USE TO THE SATISFACTION OF THE INSTRUCTOR.
2. WHEN GIVEN VARIOUS TYPES OF MOWING EQUIPMENT, ADJUST THE EQUIPMENT FOR CUTTING HEIGHT ACCORDING TO THE TYPE OF TURF AREA TO BE MOWED AND MANUFACTURER'S RECOMMENDATIONS.
3. WHEN GIVEN PROPERLY ADJUSTED MOWING EQUIPMENT, DEMONSTRATE THOSE PROCESSES AND PROCEDURES NECESSARY FOR MOWING A VARIETY OF TURF AREAS AND TURFGRASSES.
4. WHEN GIVEN PROPERLY ADJUSTED AERATING AND THATCHING EQUIPMENT, DEMONSTRATE THE ABILITY TO OPERATE THIS EQUIPMENT IN ORDER TO MAINTAIN A GIVEN TYPE OF TURF AREA TO THE SATISFACTION OF THE TEACHER OR EMPLOYER.

### B. INSTRUCTIONAL AREAS

#### 1. SELECTING MOWING EQUIPMENT

##### A. IDENTIFYING TYPES OF MOWERS AND PURPOSE

- (1) REEL TYPE
- (2) ROTARY
- (3) GREENS MOWERS

##### B. DETERMINING MOWER COSTS ACCORDING TO INTENDED USE

##### C. DETERMINING SAFETY CONSIDERATIONS OF MOWER SELECTION

## 2. MOWING PROCEDURES AND PROCESSES

- A. DETERMINING TIME AND FREQUENCY OF MOWING
- B. ADJUSTING MOWER HEIGHT
- C. MOWING CONSIDERATIONS FOR SPECIFIC TURF VARIETIES
- D. DIRECTION OF MOWING
- E. TECHNIQUES FOR REMOVING CLIPPINGS
- F. EDGING TECHNIQUES
- G. SAFETY CONSIDERATIONS FOR MOWING PROCEDURES

## 3. PERFORMING OTHER OPERATIONS RELATED TO MOWING AND MAINTAINING TURF AREAS

- A. BENEFITS OF THATCH REMOVAL
- B. ADJUSTING AND OPERATING THATCHING EQUIPMENT
- C. BENEFITS OF AERATING TURF AREAS
- D. ADJUSTING AND OPERATING AERATORS

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. A. HAVE STUDENTS SELECT MOWING EQUIPMENT FOR SPECIFIC TURF AREAS. THIS EXERCISE SHOULD INCLUDE COST CONSIDERATIONS AND ANALYSIS.  
  
B. USING PICTURES OR ACTUAL PIECES OF MOWING EQUIPMENT, HAVE STUDENTS SELECT MOWERS FOR SPECIFIC TURF AREAS.
- 2. USING VARIOUS TYPES OF MOWERS, (REEL, ROTARY, GREENS MOWERS, ETC.), HAVE STUDENTS ADJUST THE CUTTING HEIGHT FOR SPECIFIC TURF AREAS.
- 3. A. VISIT A GOLF COURSE SO STUDENTS CAN SEE THE METHODS AND TECHNIQUES OF MOWING THE VARIOUS KINDS OF TURF AREAS FOUND AT THE COURSE.  
  
B. ASSIGN STUDENTS CERTAIN AREAS OF THE SCHOOL GROUNDS FOR THE DEVELOPMENT OF MOWING TECHNIQUES.
- 4. STUDENTS SHOULD PRACTICE ADJUSTING AND OPERATING AERATORS AND THATCHERS FOR VARYING TURF AREAS.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. EACH STUDENT SHOULD BE ABLE TO MATCH VARIOUS TYPES OF MOWING EQUIPMENT TO PICTURES OR DESCRIPTIONS OF VARIOUS TURF AREAS WITH COMPLETE ACCURACY.
2. EACH STUDENT SHOULD BE ABLE TO DEMONSTRATE OR DESCRIBE ORALLY OR IN WRITING THE PROCEDURE FOR ADJUSTING CUTTING HEIGHT COMMONLY USED FOR TURF MOVERS AND EQUIPMENT ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
3. USING PICTURES, SLIDES OR OTHER VISUALS ILLUSTRATING TURF AREAS THAT HAVE BEEN SUBJECTED TO IMPROPER MOWING TECHNIQUES, EACH STUDENT SHOULD BE ABLE TO DESCRIBE ORALLY OR IN WRITING PROPER MOWING TECHNIQUES THAT WOULD HAVE PREVENTED THE POOR TURF CONDITIONS SHOWN. THE TEACHER OR EMPLOYER SHOULD EVALUATE THIS EXERCISE FOR VARYING TURF AREAS AND GRASS VARIETIES.
4. EACH STUDENT MUST DEMONSTRATE THE CORRECT PROCEDURE FOR OPERATING AERATORS AND THATCHERS ON A GIVEN TURF PLOT ACCORDING TO THE OPERATOR'S MANUAL AND TO THE SATISFACTION OF THE TEACHER OR EMPLOYER.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. VARIOUS TYPES OF MOWERS. THESE SHOULD BE HAND AND TRACTOR-DRIVEN TYPES AND SHOULD INCLUDE REEL AND ROTARY MOWERS. OPERATING MANUALS SHOULD BE AVAILABLE.
2. THATCHERS AND AERATORS

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. TURFGRASS MAINTENANCE AND ESTABLISHMENT - A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 48-52, 106-108.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS DEVELOPED FOR ORNAMENTAL HORTICULTURE. THIS REFERENCE INCLUDES A COMPREHENSIVE SECTION ON FERTILIZING TURF AREAS.

2. TURF MANAGEMENT. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, PP. 79-81.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS DEVELOPED FOR ORNAMENTAL HORTICULTURE. THIS REFERENCE INCLUDES A COMPREHENSIVE SECTION ON FERTILIZING TURF AREAS.



## MAINTAINING TURF FERTILITY

**UNIT CONCEPT:** THE FERTILIZATION AND LIMING OF TURF IS A MAJOR MANAGEMENT PROCEDURE AND, PER DOLLAR SPENT, NO PRACTICE PROBABLY SHOWS UP MORE EMPHATICALLY THAN THE APPLICATION OF FERTILIZER ON TURF. THE TURF WORKER MUST BE ABLE TO DETERMINE TURF FERTILITY NEEDS BY SOIL TESTING AND SATISFACTORILY CARRYING OUT THE RECOMMENDATIONS IN ORDER TO MAINTAIN FERTILITY.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A SPECIFIC TURF AREA, TAKE A REPRESENTATIVE SOIL SAMPLE AND PREPARE THE SAMPLE FOR ANALYSIS BY A RECOGNIZED SOIL TESTING LABORATORY TO THE SATISFACTION OF THE TEACHER OR EMPLOYER.
2. WHEN GIVEN A SOIL TEST REPORT, INTERPRET THE RECOMMENDATIONS IN TERMS OF AMOUNT, RATE AND ANALYSIS OF FERTILIZER TO APPLY WITH COMPLETE ACCURACY.
3. WHEN GIVEN A SET OF FERTILIZER RECOMMENDATIONS, SELECT THE MOST EFFICIENT AND ECONOMICAL FERTILIZERS FOR THE TURF AREA AND APPLY THE FERTILIZER AND/OR LIME ACCORDING TO RECOMMENDED PROCEDURES.

### B. INSTRUCTIONAL AREAS

1. TAKING A SOIL SAMPLE
  - A. SECURING NEEDED EQUIPMENT
  - B. PROCEDURES FOR GETTING A REPRESENTATIVE SAMPLE
  - C. SELECTING TIME OF YEAR FOR SAMPLING
  - D. PREPARING SAMPLE FOR LABORATORY ANALYSIS
  - E. FILLING IN FORMS FOR SENDING SAMPLES TO TESTING LABORATORIES



## 2. INTERPRETING SOIL TEST RESULTS

- A. DETERMINING APPLICATION PER SQUARE FOOT
- B. RECOMMENDED ANALYSIS
- C. DETERMINING TIME OF APPLICATION

## 3. SELECTING AND PURCHASING FERTILIZER AND LIME

- A. IDENTIFYING FERTILIZER FORMS AND CHARACTERISTICS
  - (1) GRANULATED
  - (2) LIQUID
  - (3) PELLETTED
- B. DETERMINING FERTILIZER RATIOS NEEDED
- C. DETERMINING NUTRIENT AVAILABILITY OF VARIOUS FERTILIZERS
- D. ECONOMICS OF FERTILIZER PURCHASING
- E. IDENTIFYING THE EFFECT OF FERTILIZERS ON VARIOUS TYPES OF TURF

## 4. APPLYING FERTILIZERS AND LIME TO TURF AREAS

- A. IDENTIFYING METHODS OF APPLICATION AND EFFECTIVENESS
- B. IDENTIFYING AND SELECTING VARIOUS TYPES OF SPREADERS
- C. CALIBRATING SPREADERS AND APPLICATORS
- D. PROCEDURES FOR EFFECTIVE AND ACCURATE APPLICATION
- E. CLEANING AND LUBRICATION PROCEDURES FOR EQUIPMENT

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. HAVE STUDENTS TAKE SOIL SAMPLES OF SCHOOL GROUNDS FOR TESTING.
  - B. HAVE STUDENTS TAKE SOIL SAMPLES FOR LOCAL RESIDENTS AND SEND TO A RECOGNIZED LABORATORY FOR ANALYSIS. THIS COULD BE A SERVICE OF THE CLASS THAT COULD IMPROVE PUBLIC RELATIONS WITH THE COMMUNITY.
  - C. IF A SOIL TESTING LABORATORY IS CLOSE TO THE SCHOOL, VISIT THE LABORATORY SO THAT STUDENTS CAN SEE SOIL ANALYSIS TECHNIQUES AND PROCEDURES.

2. STUDENTS SHOULD PRACTICE INTERPRETING SOIL TEST RESULTS FROM OIL TESTING LABORATORIES.
3. A. HAVE STUDENTS ANALYZE LABELS FROM FERTILIZER BAGS FOR ITS COMPONENTS, POUNDS OF NUTRIENTS, COST PER POUND AND APPLICATION RECOMMENDATIONS.  
 B. STUDENTS SHOULD CALIBRATE VARIOUS TYPES OF SPREADERS FOR VARIOUS RATES OF APPLICATION.  
 C. SET UP TEST PLOT WITH VARIOUS SPECIES OF TURFGRASSES TO STUDY FERTILIZERS REQUIREMENTS AND RESPONSE TO VARIOUS RATES OF APPLICATION.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. GIVE STUDENTS A DESCRIPTION OF A TURF AREA OR AN ACTUAL TURF SITE AND HAVE THEM INDICATE WHERE THEY WOULD COLLECT SAMPLES IN ORDER TO OBTAIN A REPRESENTATIVE SOIL SAMPLE. THIS EXERCISE SHOULD BE EVALUATED BY THE TEACHER OR EMPLOYER ON THE BASIS OF THE SPECIFIC SITE(S) GIVEN TO THE STUDENT.
2. EACH STUDENT SHOULD BE ABLE TO DETERMINE THE RECOMMENDED ANALYSIS AND APPLICATION PER SQUARE FOOT FOR A FERTILIZER APPLICATION FROM THE RESULTS OF A SOIL TEST WITH COMPLETE ACCURACY.
3. EACH STUDENT SHOULD BE ABLE TO CALIBRATE A FERTILIZER SPREADER FOR A GIVEN AMOUNT OF FERTILIZER TO BE APPLIED ON A GIVEN TURF AREA WITH COMPLETE ACCURACY.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. FERTILIZERS OF VARYING ANALYSES INCLUDING MICRONUTRIENTS
2. SPRAYERS
3. FERTILIZER SPREADERS (THESE SHOULD BE BOTH HAND AND TRACTOR-DRIVEN TYPES)
4. FERTILIZER BAGS FOR LABEL INFORMATION ANALYSIS
5. SOIL TESTING MAILING KITS (THESE CAN GENERALLY BE ACQUIRED IN COUNTY EXTENSION OFFICES)

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. TURFGRASS MAINTENANCE AND ESTABLISHMENT -- A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 38-48, 104-106.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS DEVELOPED FOR ORNAMENTAL HORTICULTURE. THIS REFERENCE INCLUDES A COMPREHENSIVE SECTION ON FERTILIZING TURF AREAS.

2. TURF MANAGEMENT. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, PP. 69-79.

A COMPREHENSIVE REFERENCE MANUAL WHICH INCLUDES MATERIAL ON TURF SOIL, DRAINAGE, TURFGRASS SPECIES AND VARIETIES, PROPAGATION AND TURF MAINTENANCE, INCLUDING PEST CONTROL.

## WATERING TURF AREA

**UNIT CONCEPT:** WATER IS REQUIRED BY TURFGRASS FOR GERMINATION, TISSUE FORMATION AND PHOTOSYNTHESIS AND IT ALSO MAKES THE AREA MORE ATTRACTIVE. THEREFORE, THE TURF WORKER MUST BE ABLE TO SELECT WATERING EQUIPMENT AND DETERMINE WHEN AND HOW MUCH WATER SHOULD BE APPLIED IN ORDER TO INSURE PRODUCTIVE TURF.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN VARIOUS TYPES OF WATERING EQUIPMENT, THE TURF VARIETY(IES) AND THE USE OF THE TURF AREA, SELECT THE MOST APPROPRIATE EQUIPMENT TO USE TO SUPPLY THE MOISTURE NEEDS OF THE AREA.
2. WHEN GIVEN A SPECIFIC TURF AREA, DETERMINE THE AMOUNT AND FREQUENCY OF WATERING NEEDED AND PERFORM THOSE PROCEDURES WHICH WILL MEET THE TURF AREA'S MOISTURE NEEDS.

### B. INSTRUCTIONAL AREAS

#### 1. SELECTING WATERING EQUIPMENT

##### A. IDENTIFYING TYPES OF WATERING EQUIPMENT

- (1) SPRINKLER TYPES AND STYLES
- (2) IRRIGATION LAYOUTS (PERMANENT) FOR GOLF COURSES

##### B. DETERMINING AMOUNT OF WATER NEEDED

##### C. DETERMINING FREQUENCY OF WATERING

##### D. IDENTIFYING TYPE OF TURF TO BE WATERED

##### E. DETERMINING COST OF WATERING EQUIPMENT (ECONOMICS OF SELECTION)

##### F. IDENTIFYING MAINTENANCE REQUIRED FOR VARIOUS TYPES OF EQUIPMENT

## 2. DETERMINING AMOUNT OF WATER TO APPLY

- A. FIELD CAPACITY OF SOIL AND RELATION TO WILTING POINT
- B. DETERMINING AMOUNT OF WATER AVAILABLE BY SOIL TEXTURE
- C. ANALYZING SURFACE RUNOFF OF TURF AREAS IN RELATION TO NEEDED AMOUNT
- D. DETERMINING THE RELATIONSHIP OF IRRIGATION AND FERTILIZER

## 3. DETERMINING FREQUENCY OF WATERING

- A. IDENTIFYING AND ANALYZING CHARACTERISTICS OF SOIL TYPES AS RELATED TO WATER-HOLDING CAPACITY

- (1) TEXTURE
- (2) INTERNAL DRAINAGE
- (3) PERMEABILITY
- (4) SURFACE RUNOFF

- B. IDENTIFYING CLIMATIC CONDITIONS

- (1) TRANSPIRATION
- (2) HUMIDITY
- (3) EVAPORATION
- (4) RAINFALL (AMOUNT AND FREQUENCY)

## 4. IRRIGATING GREENS AND TEES

- A. IDENTIFYING VARIETY ON GREEN OR TEES
- B. PURPOSES OF WATERING GREENS AND TURF
- C. ADJUSTING WATERING TO PLAYING REQUIREMENTS ON TEES

## C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

- 1. USING PICTURES OR ACTUAL WATERING EQUIPMENT (SPRINKLERS), HAVE STUDENTS SELECT THOSE MOST APPROPRIATE FOR SPECIFIC TURF AREAS.
- 2.
  - A. HAVE STUDENTS DISASSEMBLE SPRINKLERS AND INSPECT FOR DAMAGED WASHERS OR WORN PARTS.
  - B. STUDY VARIOUS SOIL TYPES AND TEXTURES TO DETERMINE THE WATERHOLDING CAPACITY OF THE SOIL.
  - C. VISIT A GOLF COURSE THAT HAS A UNDERGROUND IRRIGATION SYSTEM IN ORDER THAT THE STUDENTS MAY STUDY THE SYSTEM LAYOUT AND THE OPERATION OF THE SYSTEM.

D. THIS UNIT PROVIDES AN EXCELLENT OPPORTUNITY FOR STUDYING SOIL TYPES AND THE DETERMINATION OF TEXTURE, PERMEABILITY, INTERNAL DRAINAGE, SURFACE RUNOFF AND SLOPE OF TURF AREA. THESE FACTORS WILL HELP THE STUDENTS DETERMINE THE FREQUENCY OF APPLICATION.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. DEVELOP A MATCHING TEST WITH INFORMATION ABOUT SPECIFIC TURF AREAS WHICH INCLUDES SIZE, KINDS OF GRASS, AND ANNUAL RAINFALL AND HAVE THEM MATCH VARIOUS TYPES OF WATERING SYSTEMS THAT WILL MEET THE NEEDS OF THE DESCRIBED AREA. THIS TASK SHOULD BE ACCOMPLISHED WITH 95% ACCURACY.
2. HAVE EACH STUDENT LIST AND EXPLAIN THE THREE FACTORS WHICH DETERMINE THE NEED FOR WATER FOR TURF AREAS. THIS LIST SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) TYPE OF SOIL, (2) KINDS OF GRASS, AND (3) CLIMATIC CONDITIONS.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. VARIOUS TYPES OF IRRIGATION EQUIPMENT (SPRINKLERS)
2. VARIOUS TYPES OF IRRIGATION NOZZLES
3. SOIL PROFILES FOR STUDYING SOIL TYPES AND CHARACTERISTICS

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. TURFGRASS MAINTENANCE AND ESTABLISHMENT -- A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 52-58, 110-111.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS DEVELOPED IN ORNAMENTAL HORTICULTURE WHICH INCLUDES TECHNICAL CONTENT ON TURF IRRIGATION AND WATERING TECHNIQUES.

2. TURF MANAGEMENT. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, PP. 83-86.

A COMPREHENSIVE REFERENCE MANUAL WHICH INCLUDES MATERIAL ON TURF SOIL, DRAINAGE, TURFGRASS SPECIES AND VARIETIES, PROPAGATION AND TURF MAINTENANCE, INCLUDING PEST CONTROL.

## TURF WEED CONTROL

**UNIT CONCEPT:** WEEDS ARE MISPLACED PLANTS THAT ACT TO USE UP LIGHT, MOISTURE AND NUTRIENTS NEEDED BY TURFGRASSES, AND IT IS NECESSARY THAT THE TURF WORKER BE PROFICIENT IN IDENTIFYING AND EFFECTIVELY CONTROLLING THESE UNWANTED PLANTS.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A SITUATION OF WEED INFESTATION OF A TURF AREA, IDENTIFY THE WEED AND CARRY OUT THE APPROPRIATE CHEMICAL, CULTURAL, AND/OR MECHANICAL PROCEDURES PROCESSES NECESSARY FOR CONTROLLING THE WEEDS.
2. WHEN GIVEN CHEMICAL WEED CONTROL SPRAYERS, DEMONSTRATE THE ABILITY TO PROPERLY CALIBRATE THE SPRAYER, AND FOLLOWING USE, CLEAN THE EQUIPMENT FOR STORAGE.

### B. INSTRUCTIONAL AREAS

#### 1. WEED CHARACTERISTICS AFFECTING CONTROL

##### A. IDENTIFYING LIFE STYLE OF WEEDS

- (1) ANNUALS
- (2) PERENNIALS
- (3) BIENNIALS

##### B. IDENTIFYING MAJOR LEAF AND STEM STRUCTURES

##### C. IDENTIFYING REPRODUCTIVE SYSTEMS

##### D. IDENTIFYING UNDESIRABLE EFFECTS OF WEEDS IN TURF AREA

#### 2. SELECTING AND USING VARIOUS METHODS OF WEED CONTROL PROCEDURES

##### A. MECHANICAL OR PHYSICAL METHODS OF CONTROL SUCH AS MOWING TECHNIQUES

##### B. USING CULTURAL METHODS SUCH AS TILLAGE IN SEEDBED PREPARATION

### C. BIOLOGICAL CONTROL TECHNIQUES

- (1) CONTROLLING PLANT POPULATION
- (2) USING DRAINAGE PRACTICES

### D. USING CHEMICAL WEED CONTROL METHOD

- (1) DETERMINING TYPE OF HERBICIDES NEEDED TO CONTROL SPECIFIC WEED PROBLEMS
  - (A) PRE-EMERGENCE
  - (B) POST-EMERGENCE
- (2) DETERMINING TIME OF CONTROL APPLICATION
- (3) SELECTING METHOD OF APPLICATION (GRANULAR OR LIQUID)
- (4) PROCEDURES FOR SAFE HANDLING AND MIXING OF HERBICIDES
- (5) CALIBRATING EQUIPMENT
- (6) CLEANING PROCEDURES FOR EQUIPMENT

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. A. USING LABELS FROM HERBICIDES, HAVE STUDENTS LIST SAFETY PRECAUTIONS TO OBSERVE DURING AND AFTER APPLICATION.
- B. USING LABELS FROM VARIOUS HERBICIDES, STUDENT SHOULD TELL WHETHER IT IS INTENDED FOR USE AS A PRE-PLANT, PRE-EMERGENCE OR POST-EMERGENCE SPRAY AND GIVE A USE OF EACH WHEN DEALING WITH NURSERY STOCK.
- C. USING LIVE OR DRIED SPECIMENS OF WEEDS COMMON TO THE AREA, HAVE STUDENT IDENTIFY THE WEEDS AND USING REFERENCES, CITE CONTROL MEASURES TO USE.
- D. USING MAGAZINE CLIPPINGS OF ACTUAL MACHINERY, STUDENTS CAN DESCRIBE ITS USE AS IT RELATED TO HERBICIDE APPLICATION, SUCH AS SPRAYERS AND GRANULAR APPLICATORS.
- E. EACH STUDENT OR GROUP OF STUDENTS SHOULD BE ASSIGNED SECTIONS OF TURF AREAS AND GIVEN RESPONSIBILITY FOR CONTROLLING WEEDS USING CHEMICAL METHODS.
2. HAVE STUDENTS PRACTICE CALIBRATING VARIOUS TYPES OF HERBICIDE APPLICATORS.



#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. GIVE STUDENTS SPECIFIC WEED PROBLEMS AND HAVE THEM DETERMINE AND EXPLAIN ORALLY OR IN WRITING THE RECOMMENDED CONTROL AND THE METHOD AND PROCEDURE THAT SHOULD BE USED TO ACCOMPLISH CONTROL. THIS PROCESS SHOULD BE EVALUATED ON THE STUDENTS ABILITY TO MAKE THE PROPER RECOMMENDATIONS AND LIST THE IMPORTANT POINTS TO CONSIDER IN APPLYING THE RECOMMENDED PESTICIDE(S).
2. EACH STUDENT SHOULD BE ABLE TO DESCRIBE AND/OR DEMONSTRATE THE PROCEDURES FOR CALIBRATING A LIQUID HERBICIDE APPLICATOR WITH COMPLETE ACCURACY AND ACCORDING TO THE OPERATOR'S MANUAL.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. HERBICIDE CONTAINER LABELS
2. HAND SPRAYERS
3. LARGE TRACTOR-DRIVEN SPRAYERS
4. VARIOUS TYPES AND KINDS OF HERBICIDES
5. WEED SPECIMENS (LIVE AND/OR DRIED)
6. SPREADERS FOR GRANULAR MATERIALS

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. COOPERATIVE EXTENSION SERVICE BULLETINS THAT GIVE CONTROL PROCEDURES FOR COMMON LAWN WEEDS IN THE LOCAL AREA.
2. TURFGRASS MAINTENANCE AND ESTABLISHMENT -- TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURE, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 55-83.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS DEVELOPED FOR ORNAMENTAL HORTICULTURE. REFERENCE CONTAINS AN EXTENSIVE SECTION ON CONTROLLING TURF WEEDS.

3. TURF MANAGEMENT. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, PP. 89-98.

A COMPREHENSIVE REFERENCE MANUAL WHICH INCLUDES MATERIAL ON TURF SOIL, DRAINAGE, TURFGRASS SPECIES AND VARIETIES, PROPAGATION AND TURF MAINTENANCE, INCLUDING PEST CONTROL.

4. WEED CONTROL - CULTURAL AND CHEMICAL. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1969, 111 PAGES.

COMPREHENSIVE REFERENCE UNIT FOR ALL TYPES OF WEED CONTROL PRACTICES AND PROCEDURES WRITTEN FOR STUDENT USE.

## TURF DISEASE, INSECT AND ANIMAL PEST CONTROL

**UNIT CONCEPT:** INSECTS, DISEASES AND ANIMAL PESTS OF TURF AREAS CAN BE CONTROLLED IF CERTAIN FACTORS ARE CONSIDERED AND APPROVED OR RECOMMENDED PROCEDURES ARE FOLLOWED BY THE TURF WORKER.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. GIVEN TURF SPECIMENS COMMON TO THE AREA DAMAGED BY DISEASE, INSECTS OR OTHER PESTS, RECOGNIZE THE SOURCE OF THE DAMAGE EITHER ON SIGHT OR BY USING A RECOGNIZED REFERENCE.
2. GIVEN CHEMICALS, CULTURAL AND/OR MECHANICAL METHODS, CARRY OUT RECOMMENDED PROCEDURES FOR CONTROLLING SPECIFIC TURF PEST PROBLEMS.
3. GIVEN A TURF AREA, IMPLEMENT A PREVENTATIVE PROGRAM FOR PEST CONTROL CONSIDERING POSSIBLE DISEASE, INSECT, AND PEST PROBLEMS.

### B. INSTRUCTIONAL AREAS

1. IDENTIFYING TURF DISEASES AND CONTROL PROCEDURES
  - A. DETERMINING UNDESIRABLE EFFECTS OF DISEASES OF TURF
  - B. IDENTIFYING SOURCES OF TURF DISEASES
    - (1) FUNGI
    - (2) BACTERIA
    - (3) VIRUSES
    - (4) MYCOPLASMA
    - (5) NON-PATHOGENIC DISEASE SOURCES
  - C. USING VARIOUS METHODS OF DISEASE CONTROL
    - (1) IDENTIFYING AND USING RESISTANT VARIETIES FOR CONTROL
    - (2) USING SEEDBED TILLAGE AS A CULTURAL METHOD OF CONTROL
    - (3) DETERMINING LIFE CYCLE OF DISEASES AND APPROPRIATE TIME OF CONTROL
    - (4) USING CHEMICAL CONTROL

- (A) EQUIPMENT TO USE
- (B) CALIBRATION OF EQUIPMENT
- (C) SAFETY PRECAUTIONS FOR APPLICATION

2. IDENTIFYING TURF INSECTS AND ANIMAL PESTS AND THEIR CONTROL

A. IDENTIFYING INSECT DAMAGE OF TURF

- (1) DETERMINING ROOT DAMAGE
- (2) DETERMINING FOLIAGE DAMAGE

B. DETERMINING LIFE CYCLES OF COMMON TURF INSECTS

- (1) DETERMINING GROWTH STAGE FOR EFFECTIVE CONTROL
- (2) DETERMINING TIME OF SEASON FOR CONTROL

C. IDENTIFYING TYPES OF CONTROL

- (1) NATURAL
- (2) BIOLOGICAL
- (3) EXCLUSION
- (4) CULTURAL
- (5) CHEMICAL

D. DETERMINING INSECT AND ANIMAL PEST CONTROL MEASURES TO USE

- (1) IDENTIFYING INSECT(S) CAUSING DAMAGE
- (2) PRESCRIBING EFFECTIVE CONTROL FROM RECOGNIZED REFERENCES
- (3) APPLYING MOST EFFECTIVE CONTROL MEASURE

C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. USING REFERENCES THAT DESCRIBE DISEASES IN THE LOCAL AREA, STUDENTS SHOULD IDENTIFY THE CAUSE AND RECOMMENDED CONTROL MEASURES FOR VARIOUS PLANT SPECIMENS OR SLIDES OF DISEASED TURF PLANTS.
2. STUDENTS SHOULD STUDY THE LIFE CYCLES OF COMMON INSECT PESTS FOUND IN TURF AREAS TO DETERMINE THE BEST TIME AND METHOD OF CONTROL.
3. STUDENTS MAY SET UP A PREVENTIVE CONTROL PROGRAM FOR DISEASES, INSECTS AND OTHER PESTS FOR THE SCHOOL OR COOPERATIVE WORK EXPERIENCE STATION USING RECOGNIZED REFERENCES.

#### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. USING PICTURES, SLIDES OR ACTUAL TURF SAMPLES OF INSECT, DISEASE, OR PEST DAMAGE COMMONLY FOUND IN THE LOCAL AREA, HAVE STUDENTS INDICATE EITHER ORALLY OR IN WRITING THE CAUSE OF DAMAGE WITH COMPLETE ACCURACY.
2. STUDENTS SHOULD DEMONSTRATE THE PREPARATION PROCEDURE FOR APPLYING PESTICIDES TO TURF AREAS WHICH WILL MEET LEGAL AND SAFETY REQUIREMENTS AS WELL AS PROVIDE EFFECTIVE CONTROL.
3. EACH STUDENT SHOULD LIST AND EXPLAIN THE PROCEDURE FOR CALIBRATING A SPRAYER OR APPLICATOR FOR APPLYING PESTICIDES TO TURF AREAS WITH COMPLETE ACCURACY. IF POSSIBLE, THIS SHOULD BE CARRIED TO THE "FIELD" AND DEMONSTRATED ON ACTUAL TURF AREAS.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. PLANT SPECIMENS, SLIDES, FILMSTRIPS OR PICTURES SHOWING VARIOUS INSECT, DISEASE OR PEST DAMAGE
2. REFERENCE OUTLINING CONTROL MEASURES FOR COMMON LOCAL INSECTS, DISEASES OR PESTS
3. SPRAYERS OR APPLICATORS FOR PESTICIDES

#### F. EXAMPLES OF SUPPORTING REFERENCES

1. TURFGRASS MAINTENANCE AND ESTABLISHMENT. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 84-93.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS DEVELOPED IN ORNAMENTAL HORTICULTURE WHICH INCLUDES TECHNICAL CONTENT NECESSARY TO IDENTIFY AND CONTROL TURF INSECT DISEASES INSECTS AND PESTS.

2. TURF MANAGEMENT. COLUMBUS, OHIO: OHIO AGRICULTURE EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, PP. 99-109.

A RESOURCE UNIT COVERING SOILS, DRAINAGE, SPECIES AND VARIETIES, PROPAGATING AND MAINTENANCE FOR TURF MANAGEMENT. CHARTS AND DRAWINGS WITH ACCOMPANYING TEST GIVE A DETAILED OVERVIEW OF INSECT, DISEASE AND PEST CONTROL FOR TURFGRASSES.

## SAFE USE OF PEST CONTROL CHEMICALS

**UNIT CONCEPT:** PESTICIDES CAN BE VERY BENEFICIAL TO THE TURF WORKER FOR CONTROLLING PESTS, IF USED PROPERLY; HOWEVER, PROVIDIENCY MUST BE DEVELOPED WHEN HANDLING, MIXING AND STORING PEST CONTROL CHEMICALS IN ORDER TO PREVENT THE HARMFUL EFFECTS ON HUMANS, ANIMALS AND OTHER PLANT LIFE.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN LABELS FROM VARIOUS COMMONLY USED PESTICIDES, DETERMINE TYPE OF PEST(S) THAT THE PESTICIDE IS DESIGNED TO CONTROL.
2. WHEN GIVEN VARIOUS COMMONLY USED PESTICIDES, DEMONSTRATE THE RECOMMENDED PROCEDURE AND SAFETY PRECAUTIONS FOR HANDLING AND MIXING PESTICIDES.
3. WHEN GIVEN VARIOUS PESTICIDES READY FOR APPLICATION, DEMONSTRATE THE PROCEDURES FOR SAFE APPLICATION OF PESTICIDES.
4. WHEN GIVEN SURPLUS PESTICIDES AND CONTAINER, DEMONSTRATE THE PROCEDURE FOR SAFE DISPOSAL AND STORAGE OF PESTICIDES.
5. WHEN GIVEN VARIOUS COMMONLY USED PESTICIDES, DETERMINE AND FOLLOW LEGAL RESTRICTIONS AS THEY PERTAIN TO THE HANDLING, MIXING, STORAGE AND DISPOSAL OF PESTICIDES.

### B. INSTRUCTIONAL AREAS

#### 1. CLASSIFYING PESTICIDES

- A. IDENTIFYING TYPE OF PEST TO BE CONTROLLED BY PESTICIDE
- B. CLASSIFYING ACCORDING TO PESTICIDE METHOD OF CONTROL
  - (1) CONTACT
  - (2) STOMACH
  - (3) SYSTEMIC

- C. CLASSIFYING ACCORDING TO TYPE OF FORMULATION
- 2. HANDLING AND MIXING PESTICIDES SAFELY
  - A. FOLLOWING LABEL DIRECTIONS FOR PROPER AND SAFE HANDLING
  - B. DETERMINING IF PROTECTIVE CLOTHING IS NEEDED
  - C. DETERMINING LEGAL RESTRICTIONS FOR HANDLING AND MIXING PESTICIDES
  - D. FOLLOWING SAFETY PRECAUTIONS WHEN MIXING PESTICIDES
- 3. APPLYING PESTICIDES ACCURATELY AND SAFELY
  - A. DETERMINING APPLICATION RATES
  - B. CONSIDERING ENVIRONMENTAL CONDITIONS IN RELATION TO APPLICATION (WIND, ETC.)
  - C. CALIBRATING APPLICATION EQUIPMENT ACCURATELY
  - D. LEGAL RESTRICTIONS TO BE FOLLOWED IN APPLYING PESTICIDES
  - E. FOLLOWING RECOMMENDED PROCEDURES FOR ACCURATE AND SAFE APPLICATION
  - F. CLEANING EQUIPMENT ACCORDING TO LABEL AND MANUFACTURER'S RECOMMENDATIONS
- 4. DISPOSING OF SURPLUS PESTICIDES AND CONTAINERS
  - A. NEUTRALIZING POISONOUS EFFECTS
  - B. BURYING SURPLUS PESTICIDES AND CONTAINERS
  - C. DISPOSING OF EMPTY CONTAINERS
  - D. AVOIDING PESTICIDE CONTACT DURING DISPOSAL
  - E. WASHING LARGE CONTAINERS
- 5. STORING PESTICIDES
  - A. DETERMINING POSSIBLE CONSEQUENCES OF IMPROPER STORAGE
  - B. PROVIDING PROPER STORAGE CONDITIONS
  - C. AFFIXING LOOSE LABELS ON CONTAINERS

- D. DISCARDING OUTDATED AND UNIDENTIFIED CONTAINERS AND MATERIALS
- E. EXAMINING CONTAINERS PERIODICALLY FOR LEAKS AND TEARS
- F. PRECAUTIONS AGAINST POTENTIAL FIRE HAZARDS

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. OBTAIN A LIST OF COMMONLY USED PESTICIDES AND SUFFICIENT REFERENCES AND HAVE STUDENTS MAKE A CHART FOR FUTURE USE WHICH DETAILS THE NAME OF THE PESTICIDES, TYPE, CHEMICAL NATURE OR SOURCE, AVAILABLE FORMULATIONS, CROPS WHERE COMMONLY USED AND TYPE OF PEST CONTROLLED.
2. USING VARIOUS PESTICIDE LABELS, HAVE STUDENTS GIVE ALL PRECAUTIONARY MEASURES TO BE OBSERVED WHEN USING A PARTICULAR SUBSTANCE.
3.
  - A. DEPENDING ON TYPE OF EQUIPMENT AVAILABLE, HAVE STUDENTS DEMONSTRATE THE SAFEST PROCEDURE TO FOLLOW WHEN USING PARTICULAR PESTICIDES. EACH STUDENT SHOULD PERFORM THIS TASK WITH AT LEAST THREE DIFFERENT KINDS OF PESTICIDES.
  - B. STUDENT CAN DEMONSTRATE PROPER CLEANING PROCEDURES FOR AVAILABLE SPRAYERS.
  - C. STUDENTS SHOULD CALIBRATE EQUIPMENT TO ACHIEVE MOST EFFECTIVE AND SAFEST APPLICATION OF PEST CONTROL CHEMICALS.
4.
  - A. HAVE STUDENTS MAKE SAFETY SURVEY OR CHECK AT HOME FOR POSSIBLE HAZARDOUS CONDITIONS RELATING TO PESTICIDE STORAGE.
  - B. STUDENTS MAY DISPOSE OF EMPTY CONTAINERS FOLLOWING RECOMMENDED PROCEDURES.
5. WITH THE MOST COMMONLY USED PESTICIDES, HAVE STUDENTS DETERMINE AND LIST ANY LICENSES, PERMITS OR OTHER LEGAL RESTRICTIONS AS THEY PERTAIN TO THE ACQUISITION, HANDLING, MIXING, APPLICATION OR STORAGE OF THE PESTICIDES.

### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. DEVELOP A MATCHING TEST OR EXERCISE WHICH LISTS THE TYPE OF PESTICIDE IN ONE COLUMN AND THE PEST TO BE



CONTROLLED IN THE OTHER AND HAVE STUDENTS MATCH THE PROPER PEST WITH THE TYPE OF PESTICIDE WITH COMPLETE ACCURACY.

2. WITH PESTICIDE LABELS OR SIMILAR INFORMATION, THE STUDENT SHOULD BE ABLE TO DETERMINE, DESCRIBE OR DEMONSTRATE THE RECOMMENDED PROCEDURE FOR MIXING THE PARTICULAR PESTICIDE FOR A SPECIFIC CROP WITH COMPLETE ACCURACY.
3. EACH STUDENT SHOULD LIST AND EXPLAIN THE SAFETY PRECAUTIONS ONE MUST FOLLOW WHEN APPLYING CHEMICALS TO CONTROL PESTS. THIS LIST SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) READING LABEL DIRECTIONS, (2) WEARING PROTECTIVE CLOTHING, (3) CONSIDERING ENVIRONMENTAL CONDITIONS, AND (4) PROPER CLEANING PROCEDURES FOR SAFETY.
4. WHEN GIVEN A LIST OF TYPES OF CONTAINERS AND SURPLUS PESTICIDES, THE STUDENT SHOULD DESCRIBE IN WRITING OR ORALLY WITH COMPLETE ACCURACY THE RECOMMENDED PROCEDURE FOR SAFE DISPOSAL OR STORAGE OF THE LISTED ITEMS. THESE PRECAUTIONS WILL VARY ACCORDING TO TYPE OF PESTICIDES AS WELL AS TYPE AND SIZE OF CONTAINER.
5. STUDENTS SHOULD BE ABLE TO DETERMINE THE LEGAL RESTRICTIONS FOR SPECIFIC PESTICIDE MATERIALS FOR THE PARTICULAR STATE OR LOCAL AREA. THEY SHOULD ALSO BE ABLE TO EXPLAIN WHY A PESTICIDE MAY BE RESTRICTED. THEIR EXPLANATION SHOULD INCLUDE: (1) HIGH RESIDUAL ACTION, (2) TOXICITY TO HUMANS OR OTHER WARM-BLOODED ANIMALS, AND (3) POISONOUS TO POLLINATING INSECTS, BIRDS OR OTHER WILDLIFE.

#### E. INSTRUCTIONAL MATERIALS OR EQUIPMENT

1. LABELS FROM VARIOUS PESTICIDE CONTAINERS
2. SPRAYERS --- IF LARGE TANK SPRAYERS ARE NOT AVAILABLE, THE BASIC SAFETY PROCEDURES CAN BE FOLLOWED USING HAND SPRAYERS
3. VARIOUS PESTICIDES COMMONLY USED IN LOCAL AREA
4. LAWS OR OTHER LEGAL PAPERS PERTAINING TO PESTICIDES USED IN LOCAL AREA

## F. EXAMPLES OF SUPPORTING REFERENCES

1. INSECTICIDES. COLUMBUS, OHIO: OHIO AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE, THE OHIO STATE UNIVERSITY. 1973, 49 PAGES.

AN EXCELLENT AND COMPREHENSIVE REFERENCE WHICH INCLUDES MATERIAL COVERING HOW PESTICIDES CONTROL PESTS, CHEMICAL NATURE OF INSECTICIDES, LABEL INFORMATION, LEGISLATION PERTAINING TO PESTICIDE USE, APPLICATOR STORAGE, AND DISPOSAL OF PESTICIDES.

## RENOVATING OLD TURF AREAS

**UNIT CONCEPT:** SOMETIMES OLD ESTABLISHED TURF AREAS BECOME UNPRODUCTIVE FOR VARIOUS REASONS AND THE TURF WORKER MUST DETERMINE IF RENOVATION WILL IMPROVE THE AREA AND, IF SO, MUST CARRY OUT THOSE PROCEDURES OR PROCESSES NECESSARY TO RESTORE PRODUCTIVITY AND MANAGEABILITY OF THE AREA.

### A. STUDENT PERFORMANCE OBJECTIVES

THE STUDENT SHOULD BE ABLE TO:

1. WHEN GIVEN A TURF AREA IN POOR CONDITION, DETERMINE THE CAUSE(S) OF LOW PRODUCTIVITY AND DECIDE IF RENOVATION WILL CORRECT THE POOR CONDITION OR IF RECONSTRUCTION IS THE MOST FEASIBLE CORRECTIVE MEASURE.
2. WHEN GIVEN THE CAUSE(S) OF POOR CONDITION IN AN OLD TURF AREA THAT CAN BE RENOVATED, DETERMINE AND DEMONSTRATE THE PROCEDURES AND/OR PROCESSES NECESSARY TO CORRECT THE POOR CONDITION OF THE TURF AREA TO THE SATISFACTION OF THE INSTRUCTOR OR EMPLOYER.

### B. INSTRUCTIONAL AREAS

1. DETERMINING CAUSES OF POOR CONDITION IN TURF AREAS
  - A. SOIL TESTING FOR FERTILITY LEVELS
  - B. CHECKING PERCENTAGE OF UNDESIRABLE GRASSES
  - C. DETERMINING AMOUNT OF THATCH IN TURF AREA
  - D. DETERMINING SOIL COMPACTION AND AERATION
  - E. IDENTIFYING AMOUNT OF INSECT AND/OR DISEASE DAMAGE
  - F. DETERMINING WEED PROBLEMS
  - G. DRAINAGE PROBLEMS
2. CORRECTING POOR CONDITIONS THROUGH RENOVATION PROCESSES
  - A. REMOVING THATCH BY VERTICUTTER

- B. CORRECTING COMPACTION WITH USE OF AERATOR
- C. APPLYING NEEDED LIME AND FERTILIZER BASED ON SOIL TEST RESULTS AND RECOMMENDATIONS
- D. CORRECTING WEED PROBLEMS
- E. APPLYING PESTICIDES AS RECOMMENDED BY EMPLOYER
- F. RESEEDING AREA WITH DESIRABLE GRASSES AS RECOMMENDED
- G. CORRECTING MOISTURE PROBLEMS WITH DRAINAGE OR IRRIGATION (WATERING)

### C. EXAMPLES OF STUDENT LEARNING ACTIVITIES

1. STUDENTS SHOULD SURVEY SCHOOL OR HOME GROUNDS FOR AREAS NEEDING RENOVATION AND DETERMINE CAUSES OF POOR CONDITION. THEY CAN THEN OUTLINE THE PROCEDURE THEY WOULD USE TO RENOVATE THE AREA.
2. A. HAVE STUDENTS PRACTICE USING AERIFIER AND THE VERTICUTTER ON A SOD AREA.  
B. HAVE STUDENT ADJUST VERTICUTTER TO VARIOUS DEPTHS OF CUT.  
C. INDIVIDUAL OR GROUPS OF STUDENTS SHOULD BE ASSIGNED TURF AREAS NEEDING RENOVATION AND SHOULD BE RESPONSIBLE FOR PROPERLY RENOVATING THE AREA.

### D. EXAMPLES OF PROCESSES TO EVALUATE STUDENT PERFORMANCE

1. EACH STUDENT SHOULD BE ABLE TO DESCRIBE AND EXPLAIN THE FACTORS TO CONSIDER WHEN ANALYZING A TURF AREA FOR RENOVATION. THIS DESCRIPTION SHOULD DEAL WITH THE FOLLOWING TOPICS: (1) SOIL TESTING, (2) DETERMINING AMOUNT OF WEEDS, (3) CHECKING INSECT AND DISEASE DAMAGE, AND (4) DETERMINING IF DRAINAGE PROBLEMS EXIST.
2. FOR A SPECIFIC TURF AREA OR A DESCRIPTION OF A TURF AREA IN NEED OF RENOVATION, THE STUDENT SHOULD BE ABLE TO DEMONSTRATE OR LIST AND EXPLAIN THE PROCEDURES NECESSARY TO RENOVATE THE GIVEN AREA. THIS DEMONSTRATION OR DESCRIPTION SHOULD INCLUDE THE FOLLOWING FOR COMPLETE ACCURACY: (1) REMOVING THATCH, (2) AERATING, (3) APPLYING FERTILIZER AND LIME, (4) WEED CONTROL, (5) RESEEDING, AND (6) WATERING.

**E. INSTRUCTIONAL MATERIALS OR EQUIPMENT.**

1. AERATOR
2. VERTICUTTER
3. OPERATING MANUALS
4. SOIL TEST RESULTS OF TURF AREAS NEEDING RENOVATION
5. LIME, FERTILIZER IF SPECIFIC AREAS ARE TO BE RENOVATED BY STUDENTS
6. PESTICIDES AND HERBICIDES

**F. EXAMPLES OF SUPPORTING REFERENCES**

1. TURFGRASS MAINTENANCE AND ESTABLISHMENT --- A TEACHER'S MANUAL. UNIVERSITY PARK, PENNSYLVANIA: DEPARTMENT OF AGRICULTURAL EDUCATION, THE PENNSYLVANIA STATE UNIVERSITY. 1968, PP. 144-145.

ONE OF A SERIES OF TEACHER AND STUDENT MANUALS DEVELOPED IN THE ORNAMENTAL HORTICULTURE TAXONOMY. MATERIAL COVERED INCLUDES SELECTING TURF VARIETIES, MOWING, FERTILIZATION, PEST CONTROL AS WELL AS RENOVATION PRACTICES.

2. OPERATING MANUALS FOR VERTICUTTER AND AERATOR EQUIPMENT AVAILABLE.

## APPENDIX A

### RECOMMENDED MATERIALS OR EQUIPMENT

THIS LIST OF EQUIPMENT CAN BE USED AS A GUIDE IN ORDERING AND ASSEMBLING THOSE ITEMS NEEDED. MANY STATE DEPARTMENTS HAVE MORE DEFINITIVE LISTS AVAILABLE AND IT MAY BE WELL TO REQUEST THESE AS ADDITIONAL SOURCES OF INFORMATION. IN ADDITION, EXPERIENCE CAN BE AN IMPORTANT FACTOR IN DEVELOPING LISTS.

#### ARBORICULTURE

PICKUP TRUCK  
 POST HOLE DIGGER (MECHANICAL)  
 DUSTERS, CRANK  
 SPRAYERS (TRAILER, INTERNAL COMBUSTION ENGINE  
 TILLERS (SMALL)  
 FERTILIZER SPREADER (TRACTOR MOUNTED)  
 CHIPPER (POWER)  
 STUMP GRINDER  
 CHAIN SAWS  
 TREE CART  
 SHOVELS (STRAIGHT HANDLE)  
 WHEELBARROWS  
 PRUNING SHEARS (HEDGE AND TREE)  
 HAND PRUNERS  
 PRUNING SAWS  
 POLE PRUNERS  
 POLE SAWS  
 AXES  
 HATCHETS  
 HAMMERS (SMALL AND HEDGE)  
 EXTENSION LADDERS  
 STEP LADDERS  
 CLIMBING ROPE  
 CABLES (STEEL - VARIETY OF SIZES)

#### FLORICULTURE

AUTOMATIC POT WATERING SYSTEM  
 AUTOMATIC BED WATERING SYSTEM  
 AUTOMATIC MIST SYSTEM  
 AUTOMATIC FERTILIZATION SYSTEM  
 STEAM STERILIZATION SYSTEM  
 CARBON DIOXIDE INJECTION SYSTEM  
 GERMINATION CABINET  
 NON-MERCURY GREENHOUSE THERMOMETERS  
 THERMO-HUMIDOGRAPH (7 DAY)

## FLORICULTURE (CONTINUED)

INTERNAL TIMERS  
PHOTOPERIOD CLOCK TIME  
PHOTOPERIOD LIGHTING EQUIPMENT  
BLACK SHADE CLOTH  
STERILIZING COVERS  
STEAMING MANIFOLD  
STEAM RESISTANT CONNECTING HOSE  
PROBE TYPE DIAL THERMOMETER (TO 220°F)  
MASK RESPIRATORS  
RUBBER PROTECTIVE HATS COATS, GLOVES, BOOTS  
SPRING SCALE - OUNCE  
SPRING SCALE - POUND  
SHOVELS - SPADE  
RAKES - STEEL  
TROWELS  
GREENHOUSE SOIL TILLER  
SOIL BINS  
FERTILIZER BINS  
SOIL SHREDDER  
SOIL SCREEN  
FLOWER POT WASHER  
GREENHOUSE SPRAYER (ELECTRIC) 25 GALLONS  
PESTICIDE STORAGE CABINETS  
HEATING CABLE WITH THERMOSTAT  
3/4-INCH WATERING HOSES  
SKATE CONVEYER  
GREENHOUSE CARTS  
FLATS  
PORTABLE CEMENT MIXER  
WHEELBARROWS  
STORAGE REFRIGERATOR  
DISPLAY REFRIGERATOR  
DISPLAY CASES  
DISPLAY SHELVES  
FLORAL DESIGN DESK UNITS  
RIBBON RACK  
TAPE HOLDERS  
CHICKEN WIRE DISPENSER  
WRAPPING PAPER DISPENSER  
ORDER PAD  
CASH REGISTER  
STAPLER  
STORAGE CABINETS - GLASS FRONT  
STORAGE CABINETS - OPAQUE FRONT  
DISPLAY WINDOW  
SINK  
REFRIGERATOR VASES  
POTTERY AND GLASS VASES  
PAPIER-MACHE' VASES  
FLORIST SHEARS

## FLORICULTURE (CONTINUED)

FLORIST KNIVES  
STYROFOAM CUTTERS  
WIRE FORMS AND TRIPODS

## LANDSCAPE MAINTENANCE AND ESTABLISHMENT

PICKUP TRUCK  
TRACTOR (2 BOTTOM, 12-14" PLOW RATING)  
TILLER ATTACHMENT FOR TRACTOR  
LOADER FOR TRACTOR  
PLOW - 2 BOTTOM  
DISC HARROW  
CULTIVATOR  
DOZING BLADE  
ROOT PRUNER  
POST HOLE DIGGER (MECHANICAL)  
DUSTERS, CRANK  
SPRAYER (TRAILER, INTERNAL COMBUSTION ENGINE)  
TILLER (SMALL)  
TURF AERIFIER  
ROTARY MOWERS  
REEL MOWERS  
CARRY LIFT  
SOIL SHREDDER  
SOIL STERILIZATION SYSTEM (MECHANICAL)  
SOIL STERILIZATION SYSTEM (CHEMICAL)  
SOIL AUGERS  
SEEDER (TRACTOR MOUNTED)  
FERTILIZER SPREADER (TRACTOR MOUNTED)  
IRRIGATION SYSTEM - STATIONARY  
IRRIGATION SYSTEM - TRAVEL TYPE  
ELECTRIC TRIMMERS  
PLANTING BARS  
TOPOGRAPHIC TRACTOR TAPE WITH REEL  
LAWN WATER METER  
BRUSH CUTTER  
SPRING SCALE  
CHAIN SAWS  
PORTABLE CEMENT MIXER  
LOCKE HAND LEVEL  
ABNEY LEVELS  
LINE LEVELS  
HOPPER SPREADER  
CYCLONE SPREADER  
WHEELBARROWS (PNEUMATIC TIRE)  
TREE CART  
HAND GARDEN SPRAYER (2 GALLONS)  
NURSERY SPADE  
SHOVEL (STRAIGHT HANDLE  
MATTOCKS, LONG CUTTER



## LANDSCAPE MAINTENANCE AND ESTABLISHMENT (CONTINUED)

RAKES - STEEL  
RAKES - WOOD  
RAKES - MAGNESIUM  
BAR DIGGER  
SPADING FORKS  
HOES - DUTCH SCUFFLE  
HOES - NURSERY  
DIBBLE  
BUDDING AND GRAFTING KNIVES  
PRUNING SHEARS (HEDGE AND TREE)  
HAND PRUNERS  
PRUNING SAWS  
POLE PRUNERS  
POLE SAWS  
AXES  
HATCHETS  
SICKLES  
SCYTHES  
SLEDGE HAMMERS  
BULB PLANTERS  
EXTENSION LADDERS  
STEP LADDERS  
HOSES - NYLON  
CLIMBING ROPES  
STEEL ENGINEER'S TAPES (100')  
STEEL ARCHITECTS'S TAPES (50')

## TURF MAINTENANCE AND ESTABLISHMENT

TRACTOR (2 BOTTOM, 12-14" PLOW RATING)  
DOZING BLADE  
TRACTOR PULLED CART  
SPIKE TOOTH HARROW  
POWER DRAG  
STEERING SULKY  
LIQUID FERTILIZER SPREADER  
HOPPER SPREADER  
CYCLONE SPREADER  
TILLER  
AERATOR - SPOON  
LARGE SPRAYER (GASOLINE POWERED)  
SOD CUTTER  
LAWN MOWERS - RIDING  
LAWN MOWERS - ROTARY  
LAWN MOWERS - REEL - GANG  
LAWN MOWERS - REEL - GREEN  
VERTI-CUT MOWER  
LAWN ROLLER  
LAWN VACUUM  
LAWN EDGER

## TURF MAINTENANCE AND ESTABLISHMENT (CONTINUED)

GRASS TRIMMING SHEARS  
 SPRINKLER IRRIGATION SYSTEM  
 TRAVEL TYPE SPRINKLERS  
 CUP CUTTER

## NURSERY PRODUCTION

TRACTOR (2 BOTTOM, 12-14" PLOW RATING)  
 ROTOR TILLER ATTACHMENT FOR TRACTOR  
 LOADER FOR TRACTOR  
 PLOW - 2 BOTTOM  
 DISC HARROW  
 SPIKE TOOTH HARROW  
 CULTIVATOR  
 DOZING BLADE  
 ROOT PRUNER  
 POST HOLE DIGGER (MECHANICAL)  
 SPRAYER (TRAILER, INTERNAL COMBUSTION ENGINE)  
 POWER TILLER (SMALL)  
 TURF AERIFIER  
 ROTARY MOWERS  
 REEL MOWERS  
 CARRY LIFT  
 SOIL SHREDDER  
 SOIL STERILIZATION SYSTEM (MECHANICAL)  
 SOIL STERILIZATION SYSTEM (CHEMICAL)  
 SEEDER (TRACTOR MOUNTED)  
 FERTILIZER SPREADER (TRACTOR MOUNTED)  
 IRRIGATION SYSTEM - STATIONARY  
 IRRIGATION SYSTEM - TRAVEL TYPE  
 DUSTER  
 PLANTING BAR  
 TOPOGRAPHIC TRACTOR TAPE WITH REEL  
 LAWN WATER METER  
 BRUSH CUTTER  
 GERMINATION CABINET  
 SPRING SCALE  
 CHAIN SAWS  
 HOPPER SPREADER  
 CYCLONE SPREADER  
 WHEELBARROW (PNEUMATIC TIRE)  
 TREE CART  
 HAND GARDEN SPRAYERS (2 GALLONS)  
 NURSERY SPADES  
 SHOVELS, (STRAIGHT HANDLE)  
 MATTOCKS, LONG CUTTER  
 PICKS  
 RAKES - STEEL  
 RAKES - WOOD  
 RAKES - MAGNESIUM

## NURSERY PRODUCTION (CONTINUED)

BAR DIGGER  
SPADING FORK  
HOES - DUTCH SCUFFLE  
HOES - NURSERY  
DIBBLES  
BUDDING AND GRAFTING KNIVES  
PRUNING SHEARS (HEDGE AND TREE)  
HAND PRUNERS  
PRUNING SAWS  
POLE PRUNERS  
POLE SAWS  
AXES  
HATCHETS  
SICKLES  
SCYTHE  
SLEDGE HAMMERS  
STEP LADDERS  
HOSES - NYLON  
HOSES - RUBBER  
STEEL ENGINEER'S TAPES (100')

## APPENDIX B

### SUGGESTED REFERENCES FOR INSTRUCTIONAL UNITS

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STATE DEPARTMENT OF VOCATIONAL EDUCATION.
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STATE DEPARTMENT OF VOCATIONAL EDUCATION. 818 PAGES.
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AGRICULTURAL EDUCATION CURRICULUM MATERIALS SERVICE,  
THE OHIO STATE UNIVERSITY. 1969, 111 PAGES.

## APPENDIX C

### SELECTED LIST OF PROFESSIONAL AND TECHNICAL SOCIETIES AND ORGANIZATIONS CONCERNED WITH ORNAMENTAL HORTICULTURE AND ITS APPLICATION

INCLUSION OR OMISSION OF AN ORGANIZATION OR SOCIETY IN THIS LIST DOES NOT IMPLY APPROVAL OR DISAPPROVAL OF IT. ADDITIONAL INFORMATION REGARDING LOCAL CHAPTERS OR SECTIONS OF THESE ORGANIZATIONS OR SOCIETIES MAY BE OBTAINED BY WRITING DIRECTLY TO THE EXECUTIVE SECRETARY AT THE LISTED ADDRESS.

AMERICAN ASSOCIATION OF BOTANICAL GARDENS AND ARBORETUMS,  
DEPARTMENT OF HORTICULTURE, NEW MEXICO UNIVERSITY, BOX 530,  
UNIVERSITY PARK, NEW MEXICO 88070

AMERICAN ASSOCIATION OF NURSERYMEN, INC., 835 SOUTHERN  
BUILDING, 15TH AND H STREETS, NW., WASHINGTON, D.C. 20005

AMERICAN FORESTRY ASSOCIATION, 919 17TH STREET, NW.,  
WASHINGTON, D.C. 20006

AMERICAN HORTICULTURAL SOCIETY, INC., 1600 BLADENSBURG  
ROAD, NW., WASHINGTON, D.C. 20002

AMERICAN INSTITUTE OF PARK EXECUTIVES, INC., OGLEYBAY  
PARK, WHEELING, WEST VIRGINIA 26003

AMERICAN RHODODENDRON SOCIETY, 3514 NORTH RUSSET STREET,  
PORTLAND, OREGON 97200

AMERICAN ROSE SOCIETY, 4048 ROSELEA PLACE, COLUMBUS, OHIO  
43200

AMERICAN SEED TRADE ASSOCIATION, SOUTHERN BUILDING, SUITE 803,  
1030 15TH STREET, NW., WASHINGTON, D.C. 20005

AMERICAN SOCIETY FOR HORTICULTURAL SCIENCE, DEPARTMENT OF  
HORTICULTURE, MICHIGAN STATE UNIVERSITY, EAST LANSING,  
MICHIGAN 48823



AMERICAN SOCIETY OF LANDSCAPE ARCHITECTS, INC., 2000  
K STREET, NW., WASHINGTON, D.C. 20006

HOLLY SOCIETY OF AMERICA, INC., P.O. BOX 8445, BALTIMORE,  
MARYLAND 21234

INTERNATIONAL PLANT PROPAGATOR'S SOCIETY, RUTGERS THE  
STATE UNIVERSITY, DEPARTMENT OF HORTICULTURE, NEW BRUNSWICK,  
NEW JERSEY 08903

INTERNATIONAL SHADE TREE CONFERENCE, 1827 NEIL AVENUE,  
COLUMBUS, OHIO 43210

MEN'S GARDEN CLUBS OF AMERICA, 50 EATON STREET, MORRIS-  
VILLE, NEW YORK 13408

NATIONAL ARBORISTS ASSOCIATION, P.O. BOX 426, WOOSTER, OHIO  
44691

NATIONAL ASSOCIATION OF GARDENERS, INC., 194 OLD COUNTRY  
ROAD, MINEOLA, NEW YORK 11501

NATIONAL LANDSCAPE NURSEYMEN'S ASSOCIATION, P.O. DRAWER  
281, LEESBURG, FLORIDA 32748

NATIONAL PARKS ASSOCIATION, 1300 NEW HAMPSHIRE AVENUE,  
NW., WASHINGTON, D.C. 20036

SOCIETY OF AMERICAN FLORISTS, SUITE H-220, SHERATON PARK  
HOTEL, WASHINGTON, D.C. 20008

SOCIETY OF AMERICAN FORESTERS, SUITE 300, 1010 16TH STREET,  
NW., WASHINGTON, D.C. 20036

WOMAN'S NATIONAL FARM AND GARDEN ASSOCIATION, 3017 MILITARY  
ROAD, WASHINGTON, D.C. 20015